Power to the Moderates!
Fiscal Windfalls and Electoral Accountability*

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Abstract

Several studies show that fiscal windfalls tend to foster political corruption and diversion, relating their explanations to agency theory. We argue the opposite, that fiscal windfalls may in fact improve accountability by stimulating the electoral participation of moderate citizens more than that of the extremes. The resulting drop in voter polarization increases the competitiveness of elections and weakens politicians' incentive to extract rents. We test these propositions on rich panel data from Norwegian local governments, many of which receive large revenues from hydropower plants. Using time-variation in hydropower production as instrument for local government revenues in combination with a triple difference approach, we obtain causal evidence in line with our propositions: Fiscal windfalls tend to boost electoral participation, reduce voter polarization, and limit the wage growth of the political elite.

JEL: H3, O13, P48.

Keywords: fiscal windfalls, turnout, voter polarization, accountability, political rents.

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1 Introduction

Is the abuse of political office an inescapable consequence of democratic governance (e.g., Brennan and Buchanan 1980), or will political competition ensure that the elites work for the benefit of the people (e.g., Wittman 1989)? A direct approach to answering this question is to evaluate the effects of a massive government revenue shock. According to the "opportunity makes a thief" logic, the windfall should make politicians more prone to corruption and diversion. In the efficient government view, however, citizens should be expected to increase their political participation, so as to discipline politicians and bureaucrats. Discouragingly, existing evidence suggests citizens remain passive. In Brazil, local oil revenue windfalls fail to increase welfare (Caselli and Michaels, 2013), and voters appear unable to punish incumbents for poor performance (Monteiro and Ferraz, 2014). Moreover, federal windfall transfers increase corruption and deteriorate mayor candidate quality (Brollo et al., 2013). Comparing less transparent non-tax revenues to more transparent tax revenues, non-tax revenues from oil in Brazil (Martínez, 2016) and grants in Colombia (Gadenne, 2017) tend to go missing, even though politicians in both cases tend to be held accountable for tax revenues. Only in the longer run (Monteiro and Ferraz, 2014), or if they somehow get exogenously informed about the windfall (Paler, 2013), voters may learn to punish bad performance.

We propose a new accountability mechanism suggesting that fiscal windfalls may, in fact, *improve* electoral accountability when citizens are sufficiently informed. Using a simple model to clarify our argument, we argue that a fiscal windfall increases citizens' perception of the election stakes so as to stimulate overall electoral participation. While there is no reason that higher turnout *per se* should promote political competition and accountability, our model suggests that participation will increase more among those citizens with less extreme political preferences (e.g., in the left-right ideology dimension), since the politically more extreme citizens are more inclined to participate in any case. The resulting decrease in voter polarization is then expected – across a range of alternative (pre-election and post-election) political equilibrium mechanisms – to sharpen the parties' competition for votes and reduce their scope for rent extraction and wasteful spending. Hence, economic outcomes may improve even *beyond* the pure fiscal revenue effect, via its disciplining effect on politicians' and parties' behavior.

We test key features and predictions of our model on data from Norwegian local governments, which offers an almost ideal quasi-natural experiment for our purpose. Relative to the countries in existing studies (e.g., Brazil and Colombia), Norway is characterized by established democratic institutions and a more developed information environment – exactly where we would expect our proposed accountability mechanism to be most relevant.[1] Moreover, Norway has the world's highest per capita level of hydropower production, and local authorities receive considerable revenues when production facilities are located in the municipality. Importantly, hydropower revenues are exempted from the local government revenue equalization scheme, implying that the windfalls substantially increase the hydropower rich governments' fiscal flexibility. We therefore use information about the location and timing of hydropower capacity shocks as a source of variation in fiscal windfalls. Investments in hydropower production are subject to extensive national regulation, implying that the associated revenue shocks are largely orthogonal to variation in local political and economic conditions. Beyond the local government revenue pass-through, there are only very weak, if any, local economic effects of the hydropower production. Thus, when studying how our (instrumented) fiscal windfalls causally affect measures of voter behavior and political effectiveness, we may confidently attribute the observed effects to the fiscal windfalls rather than various macroeconomic production spillovers.

Our first main result is that fiscal windfalls identified from hydropower shocks significantly increase citizens' propensity to participate at elections, consistent with our key theoretical assumption. This pattern can even be seen in the raw data, as illustrated in the left panel of Figure 1, displaying cross-sectional averages of five waves of the Local Election Studies in the period 1999 to 2015.[2] Respondents in municipalities with government revenues from hydropower production (grey dots) are considerably more likely to

[1] A key condition for our mechanism to be relevant is that citizens are aware of the fiscal windfalls, for example by reading newspapers. In addition to being well educated, data provided by UNESCO Institute for Statistics shows that Norway has the highest newspaper consumption in the world (together with Japan, Iceland, Hong Kong and Aruba). By contrast, newspaper consumption in Brazil is about one tenth of that in Norway. See Online Appendix Figure B5 for the most recent development in newspaper readership in Norway (2003-2015), for comparison plotted by hydropower intensity.

[2] Notes to the data in Figure 1: The left panel uses individual-level data from the Local Election Studies in 1999, 2003, 2007, 2011 and 2015 (N=11.683). The datasets includes information of citizens left-right self-placement where 0 indicates the extreme left and 10 the extreme right, as well as data on participation in the local elections. We merge these data with municipality-level information on per capita levels of hydropower production. The bubblesizes are proportional to number of respondents. The regression lines indicates the quadratic fit.

The right panel shows the municipality-level changes in per capita hydropower production (in MWh per capita) and voter polarization from 1991 to 2015. Voter polarization is measured by exploiting survey data on parties' left-right positions and voter support for the parties in the municipal council elections in 1991 and 2015. Further details on the polarization index are presented in Section 4 and notes to Table 3.

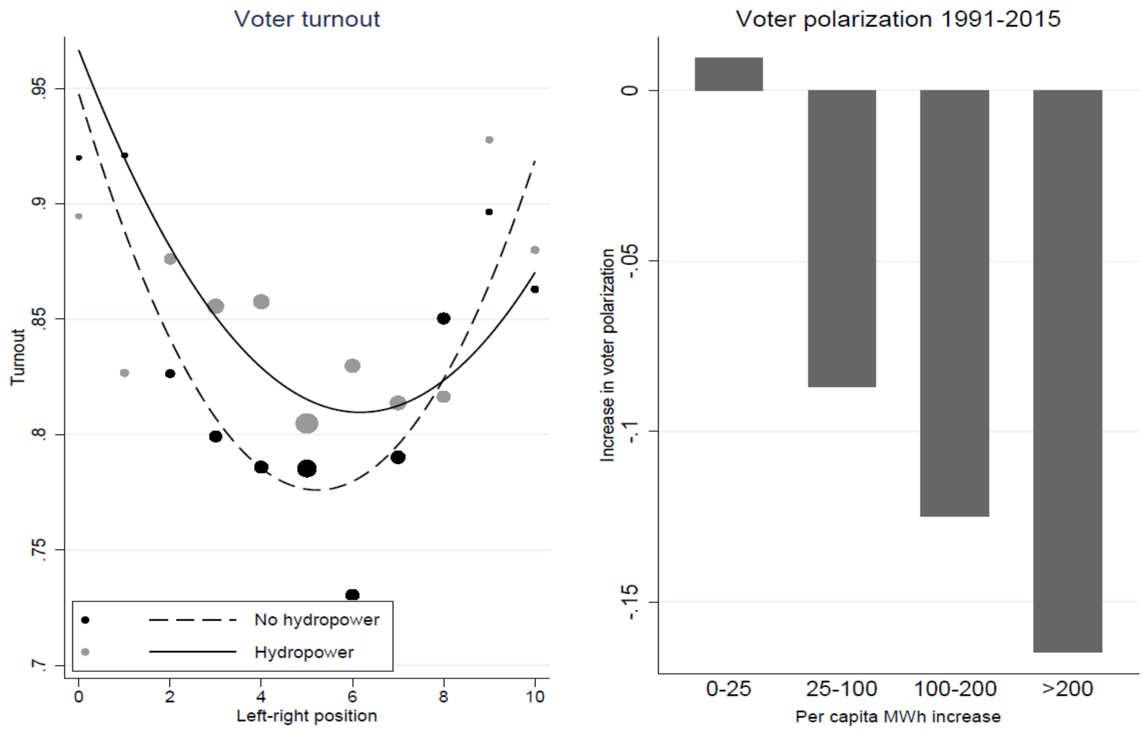

Figure 1: Voter turnout in the cross-section and polarization over time, by per capita hydropower capacity (survey data).

participate in the local elections than those in municipalities without hydropower revenues (black dots).[3] Moreover, the higher overall turnout stems primarily from the higher participation among the more centrist (at the same left-right scale) citizens, which is consistent with our proposition that there is a negative association between fiscal windfalls and voter polarization.[4] Moving from cross-sectional raw data patterns to associations over time, the right panel of Figure 1 illustrates that voter polarization from 1991-2015 tends to have decreased considerably more in municipalities that experienced substantial increases in hydropower capacity (larger than 25 MWh per capita, amounting to annual hydropower

[3] An accompanying Figure B1 in the Online Appendix shows a very similar pattern for the distribution of citizens' perceived importance of the local election, consistent with our argument.

[4] The U-shaped tournout pattern in Figure 1 – i.e., that the rate of abstention is higher at the center of the ideological spectrum – appears to generalize to a number of countries. Rodon (2017, Table 1) employs European National Election Surveys, and shows that citizens located at the central of the left-right scale are less likely to cast their votes. We return to this U-shape in our theory discussion.

windfalls of about USD 50 per capita, or more), compared to no change in the hydropower-poor municipalities (the left bar). Moreover, this figure suggests scale effects: the observed average decrease in polarization is considerably stronger among those municipalities that have experienced larger hydropower capacity additions.

Analyzing the data more rigorously – using panel regressions with year and municipality fixed effects, and instrumenting the fiscal revenue windfalls using our time-varying measures of hydropower production capacity – the results are consistent with the raw data patterns, providing strong support for our model's key predictions. Fiscal windfalls significantly increase local election voter turnout, while they reduce the level of voter polarization. Auxiliary analyses of survey data show that, when a local government receives a fiscal windfall, citizens attach greater importance to the local elections, supporting our preferred interpretation of the turnout patterns. Moreover, the increase in political participation extends beyond voting, to newspaper consumption, information gathering, and engaging in local politics more broadly. Moving on to analyzing political rents, the hydropower windfalls do not increase any of our measures of elite compensation, including the wage levels of the mayor and the chief municipal officer (CMO; "rådmannen"), their respective wage ratios relative to local government employees, and the size of the local council and its internal spending level. In fact, the estimates on top official wages are consistently *negative* (relative to a positive wage trend) and in about half of the cases we study statistically significant at conventional levels. Note that a negative rent effect is consistent with our proposed accountability mechanism but not with standard agency models, even when shutting down information asymmetries or political selection mechanisms.

Our findings are robust. First, as mentioned, they are not driven by fixed municipality characteristics or common time trends. Second, we demonstrate that the turnout and polarization results survive differencing out potentially omitted time-varying variables at the municipality level. The motivation for this exercise is that hydropower-rich municipalities are systematically different from other municipalities, as they are often smaller and located in more rural parts of the country. If the local trends in political sentiment correlate with any such characteristic, and at the same time correlate with the local hydropower trends, this would not be captured by the regression models' municipality and year fixed effects. To account for this concern, we take advantage of data from a different, simultaneously held election – the county council election – which is also organized at the municipality level. The two elections take place on the same day and in the same voting booth. Assuming that the local government hydropower windfalls do not affect outcomes in the county council elections, the difference in outcomes across the two elections should net out any potentially spurious trend effects. Estimating this triple-difference specification – that is, the *difference* in outcomes at *different* windfall levels across *different* elections – we document that our main results hold: the fiscal windfalls increase voter turnout and decrease voter polarization in local relative to county elections. This is a strong test as, if anything, we would expect voters' behavior in the local election to spill over to their behavior in the county election, causing a downward bias in the triple-difference estimates.

A remaining concern is that local agents (citizens and politicians) might form expectations about future fiscal windfalls and adjust their behavior accordingly. We address this concern in three ways. First, we estimate a dynamic specification of our revenue regression (the first-stage of our IV analysis) demonstrating that there are no visible pre-windfall effects, but a marked 'jump' at the time of the windfall. Second, we show that future hydropower production additions cannot be explained by initial municipality characteristics, nor by the municipality's hydropower history, suggesting that future hydropower additions are indeed very difficult to predict. Finally, our main results are robust to using an alternative instrument: a reform in the grant system that discontinuously increased the central government's transfers to small municipalities.

Our paper contributes to several strands in the literature. In addition to the broad and long-lasting literature on the (in)efficiency of democracy and the nascent empirical literature on fiscal windfalls reviewed above, our proposed mechanism and results are relevant for the resource curse literature (see van der Ploeg, 2010, for a broad review). In particular, comparing our findings to those from Brazil and Colombia, the overall patterns are consistent with institutional nonlinearities; that resource windfalls may have positive economic effects if institutional quality is sufficiently good, but adverse effects in weakly institutionalized settings (e.g., Mehlum et al., 2006). While our findings suggest that resource windfalls may increase accountability so as to reduce the scope for political rent extraction in institutionally developed settings, Andersen et al. (2017) document the opposite effect in institutionally weak settings, where oil windfalls are shown to increase the capital flow to deposits in tax havens (an indicator of embezzlement by the elite). At the local level, Knutsen et al. (2017) document an increase in corruption as a response to local mining shocks in Africa.[5]

[5] A different branch of this literature documents that resource rents increase local violent conflict in institutionally and economically weakly developed contexts (see, e.g., Berman et al., 2017, and the references therein).

A smaller literature focuses explicitly on the political or economic effects of local government hydropower revenues in Norway. Andersen et al. (2014) show that hydropower revenues causally increase turnout in Norwegian local elections, relying on cross-sectional data and a triple-difference procedures similar to ours, but without considering political accountability mechanisms. Geys et al. (2017) analyze the empirical association between fiscal performance and CMO compensation. They show that CMOs in Norwegian local governments are rewarded for performance – in terms of both higher wages and longer tenures – while there is no evidence that they are rewarded for luck, using a hydropower instrument for the identification of luck. Borge et al. (2015) document that local governments with higher general per capita revenues are less efficient in their public goods production, independent of whether the revenues stems from the natural resource sector or other sources.[6]

Our findings are also related to the literature on local macroeconomic effects of resource windfalls, which documents positive general equilibrium effects from spillovers in developed economies, but potentially less positive effects in less developed economies (e.g., Alcott and Keniston, 2017; Komarek, 2016; Aragón and Rud, 2013; Michaels, 2010).[7] In contrast to this literature, our instrument allows us to explicitly focus on the government budget channel of such spillovers. While outside the scope of the current paper, the general boost in government revenues from hydropower windfalls could potentially trigger local Dutch disease effects in the medium to long run (e.g., Corden and Neary, 1982), causing local cost inflation and the crowding out of competitive industries.

Finally, our paper contributes to the literature on electoral behavior, including voter turnout, media consumption, and information collection (e.g., Palfrey and Poole, 1987; Degan and Merlo, 2011; Gentzkow et al., 2011), analyzing voters' information acquisition and aggregation (e.g., Feddersen and Sandroni, 2006; Larcinese, 2007; Hodler et al., 2015, Levy and Razin, 2015), and demonstrating that voter information is a key determinant of political accountability and rents (e.g., Glaeser and Saks, 2006; Snyder and Strömberg, 2010). However, these contributions do not relate the patterns of electoral participation and accountability directly to fiscal windfalls and the election stakes, as we do.

The remainder of the paper is structured as follows. In Section 2, we propose a sim-

[6] Other papers focusing on local oil windfalls document that, while childrens' education via their parents' income are not affected (Løken, 2010), the windfalls might have had a positive impact on the affected cohorts' propensities to vote at elections (Finseraas, 2017).

[7] See, e.g., Cust and Poelhekke (2015) for a review.

ple theoretical framework, discuss implications, and derive predictions that can be tested on the data. Section 3 characterizes the Norwegian institutional setting, including the structure of hydropower production and the details of the tax system. Section 4 lays out our empirical strategy, relating this to the characteristics of our data and variables. Our empirical results are presented and interpreted in Section 5. Section 6 provides a battery of robustness checks, with particular attention on our timing assumptions and instrument validity. Finally, Section 7 sums up and concludes.

2 Theory discussion: Voter Mobilization and Political Accountability

Fiscal shocks, election stakes, and turnout

The starting point in our simple model is the assumption that a citizen's participation is influenced by how strongly she feels about party ideology (or, more generally, party labels). That is, in a one-dimensional left-right space, for a given left-right distribution of citizens' ideology preferences, we assume that those citizens at the most extreme positions have a stronger intrinsic motivation to participate in the election *per se*. This type of voter behavior is consistent with, for example, expressive voting motives. Assuming a fixed cost of voting, baseline turnout is then expected to be the highest among the citizens at the most extreme left-right positions. Notice that this is consistent with the U-shaped relationship between turnout and ideological self-placement in Figure 1.

Second, we assume that a citizen's participation motive is influenced by the overall economic stakes of the election. Then, for a given distribution of 'stakes preferences' – that is, how intensely a citizen cares about the stakes of the election (assumed orthogonal to the ideology preference distribution) – a positive shock to the election stakes shifts up the turnout distribution. Moreover, the marginal turnout response is stronger among the more centrist citizens, since these where the most inclined to abstain in the first place.

For illustration, consider the specific parameterization of this model shown in Figure 2.[8] For simplicity, in the figure we assume that citizens' preference distributions (over ideology and stakes) are uniform and orthogonal, where the ideology preference of citizen i is given by $\sigma^i \sim U\left[-\frac{1}{2\varphi}, \frac{1}{2\varphi}\right]$ and the citizen's stakes preference is given by $S^i \sim U\left[0, S^{hp}\right]$. Additionally, we assume some positive voting cost $C > 0$. Then citizen i's net benefit of

[8] For a more detailed analysis, see the Theory Appendix.

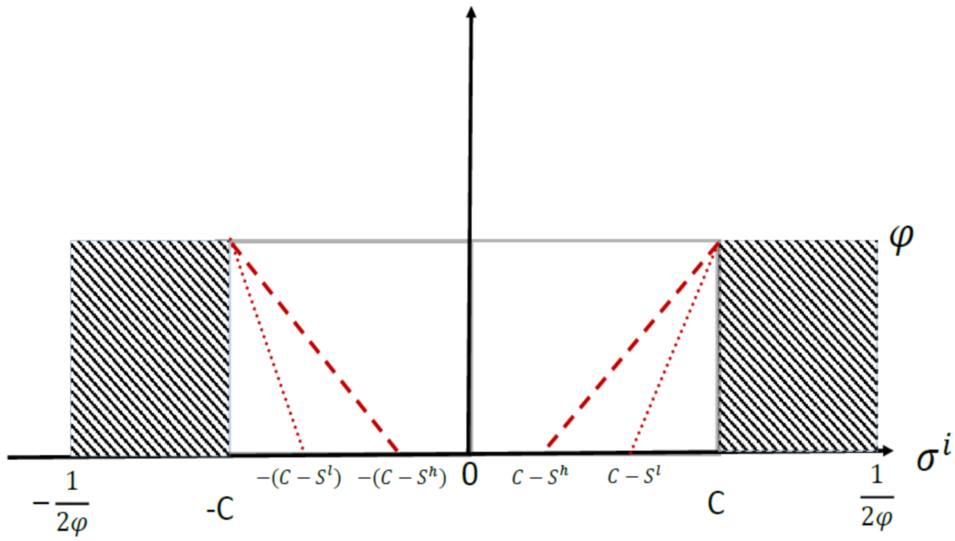

Figure 2: Graphical illustration of voter distributions.

voting B^i is given by the sum of her feelings towards any of the parties and her perception of the election stakes, net of voting costs, implying

$$B^i = \left|\sigma^i\right| + S^i - C.$$

In the case of zero election stakes ($S^{hp} = 0$), only those citizens with $\left|\sigma^i\right| > C$ will participate, implying the U-shaped (bimodal) participation pattern illustrated by the hatched areas in Figure 2. Hence, when stakes are low, only those citizens at the most extreme positions in the ideology dimension participate. Increasing the election stakes slightly ($S^{hp} = \varepsilon$), some of those voters with ideology preferences slightly weaker than C will at the margin find it beneficial to participate. Increasing the stakes further to $S^{hp} = S^l > \varepsilon$, the turnout distribution is characterized by the sum of the hatched areas and the areas below the (red) dotted line – still U-shaped, but with more mass towards the center of the ideology distribution. Increasing the stakes even further, to $S^{hp} = S^h > S^l$, the distribution continues shifting up to the (red) dashed line, with even more mass towards the center of the distribution, and so on. Finally notice that, given our distributional assumptions, the mass at the center will continue to increase as S^{hp} increases, but the U-shape will be preserved, as there will always exist a positive mass of voters around the center of the ideology distribution that will abstain in the election (i.e., that are characterized by $\left|\sigma^i\right| + S^i < C$).[9]

Political equilibrium implications: Voter polarization and rents

The empirical pattern in Figure 1 and the theoretical distribution in Figure 2 suggest that a positive shock to the election stakes mobilize voters so as to decrease voter polarization. If so, how might this affect parties' competition for votes and their economic policies in political equilibrium?

Imagine a situation where there are two parties competing for some benefit of holding office, and where the winning party gets all the benefits. To the extent that benefits from holding office in the form of political rents are perfectly observed and the parties can commit to a level of rents, the parties may compete for votes by promising lower rents.[10] Citizens and parties know the state of the world (S^{hp}, φ, and C), and citizens decide whether to vote or abstain, while each party $P = L, R$ decides on a political rent strategy ρ_P so as to maximize their expected rents (from which they derive utility). In a standard Downsian election race, there would be a Bertrand competition for votes, driving ρ_P all the way down to zero. However, in our case, absention by centrist voters – and the resulting endogenous (to the election stakes) gap in the ideological distribution of voters – breaks this equilibrium and implies positive equilibrium rents. The intuition is that, starting from zero rents, either party may increase their proposed rents without losing votes, up to the point where, say, the proposed rent of the L-party (relative to the R-party) is sufficiently high to make the marginal L-voter indifferent between voting for L or R (and vice versa). Hence, the (upper bound on the) equilibrium level of rents will be *decreasing* in the election stakes, since higher election stakes closes the gap in the voter distribution, effectively reducing voter polarization.

[9] That $S^h > S^l$ is not obvious, as the relationship between revenue windfalls and stakes may be different across different types of elections and settings. Below, we provide evidence consistent with this assumption in the context of hydropower windfalls in the Norwegian setting. For additional evidence and a more rigorous analysis of the microfoundation for this relation, see the theory discussion in the Online Appendix of Andersen et al. (2014), which can be downloaded at: www.jon.fiva.no.

[10] In our setting, political rents may be interpreted broadly as the residual of local government revenues (net of government spending), including everything from outright corruption, to diversion, and government waste. Alternatively, rents may be interpreted as the utility gain for politicians of exerting low (relative to high) effort. Our definition of political rents is closely related to, e.g., Bandiera et al.'s (2009) notion of active (as opposed to passive) waste in public spending.

Discussion: Alternative theory setups

Even though the above analysis is highly stylized, the core result that equilibrium rents are decreasing in the election stakes appears remarkably robust across a number of alternative pre-election and post-election setups. First, the result is preserved in a standard probabilistic voting setup with more general assumptions about voters' ideological distribution (see, e.g., Polo, 1998), the intuition being that a higher mass of centrist "swing" voters (i.e., less polarization) makes it more costly at the margin for a party – in terms of reduced win probability – to offer a higher level of political rents.

Voter ideology is less salient in post-election setups (agency models), where voters decide whether to reelect the incumbent or to vote for a generic incumbent based on their assessment of the incumbent's performance while in office. In such setups, electoral accountability crucially hinges on the voters' ability to coordinate their voting strategies (Ferejohn, 1986). If electoral polarization is detrimental to coordination, high polarization may be exploited by the incumbent to extract rents (as in, e.g., Ferejohn, 1986, Proposition 7, and Persson and Tabellini, 2000, Ch. 9, Problem 3). Hence, our proposed mechanism whereby an increase in the election stakes mobilizes centrists (i.e., more ideologically homogeneous voters) to participate at higher rates may be expected to reduce equilibrium rents via an increase in coordination ability.

Predictions

The above theory and discussion suggest the following predictions. Fiscal windfall revenues are expected to: (*i*) increase the level of voter turnout; (*ii*) reduce the level of voter polarization; and (*iii*) limit the extraction of political rents.

3 Institutional setting

Hydropower resources

Norway is one of the world's largest hydropower producers (after China, Canada, Brazil, USA and Russia) – about 96 percent of domestic electricity consumption is covered by hydropower. Government regulations of hydropower ownership and taxation have a history of more than a hundred years. When these regulations were shaped, a key idea was that the local communities – and not only those who owned the waterfalls – should be both compensated for the damage on the natural environment and also claim a share of the values creased on basis of local waterfalls.[11] During the formative period of 1906-1917, the national parliament – Stortinget – adopted a number legislative initiatives based on these principles. All the elements of this regulatory framework is effective even today. In 2016, about 70 percent of Norwegian local governments received fiscal revenues linked to hydroelectric power generation (see below).

The Norwegian Water Resources and Energy Directorate (NVE) handles applications for hydropower development. Such applications require a comprehensive assessment of economic feasibility, property rights, and the projects' environmental impact, including effects on water systems, ecological diversity, and cultural sites.[12] Applicants are required to conduct extensive and expensive investigations to assess these effects. The NVE makes final decisions on smaller projects. In larger projects, the NVE prepares the decisions to be made by the Ministry of Petroleum and Energy. The regulatory framework is complex. A recent survey covering 2009-2013 showed that average NVE processing time was three and a half years for small-scale applications, and in larger projects, nearly eight years. Almost all larger hydropower projects, and about a third of the smaller projects are appealed, which adds additional years of processing time. The timing of production openings may also be influenced by delays in construction time. This complexity leaves the local authorities with negligible influence on the exact timing of production start-up.

The potential for hydropower production ultimately depends on the volume of water in mountain reservoirs and their altitudes relative to the sea level plants. Because Norway is mountainous all the way from the north to the south, hydropower can be produced in large parts of the country. The larger share of facilities are located on the south- and west-coast and in parts of Northern Norway, which have high mountains and ample precipitation. The geographical distribution of energy production is illustrated in Figure 3.[13]

The structure of local government

The Norwegian system of government comprises the central government, 19 county authorities, and about 428 municipalities. The local government sector – including both

[11] According to a draft resolution to the Norwegian Storting, St.prp. nr 1 (2003-2004), chapter 3.1 (in our own translation): "A share of the values in hydropower production shall go to the host municipalities as compensation for power production. This has been partly justified as a reimbursement to the municipalities for the degradation of natural values, and partly because the municipalities should receive a share of the value creation derived from the exploitation of local natural resources."

[12] For further documentation of licencing, see: https://www.nve.no/licensing/?ref=mainmenu

[13] The data in the map refers to 2013. "Small hydropower production" means less than 400 MWh per capita, while "Large hydropower production" corresponds to a per capita production higher than 400 MWh.

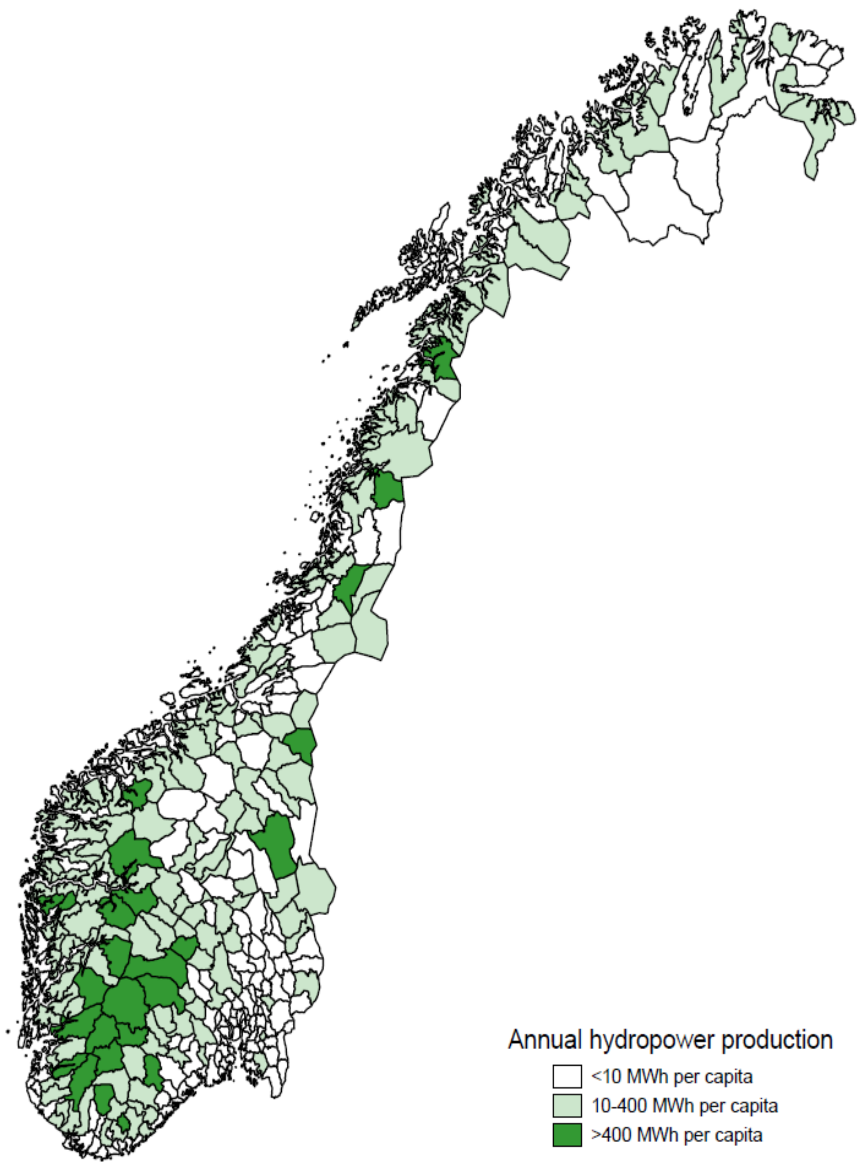

Figure 3: The geographical distribution of hydropower production in Norway.

county and municipal authorities – accounts for about half of total government consumption and 20 percent of GDP.

Local governments are an integral part of the public sector, being responsible for implementing national welfare policies such as primary education, health care services, social welfare, and infrastructure. They face significant regulatory constraints relating to both the spending (quality standards and entitlements of service provision) and revenue side of the budget, relying to a very large degree on grants from the central government and tax schedules constrained by central government regulations. There are few formal limitations on the local governments' freedom to allocate ordinary taxes and grants from the central government. Yet, the central government has imposed nationwide quality standards on schooling, health care and social services. These regulations tie up most of the ordinary revenue allocations. Since hydropower production substantially supplements the local governments' revenues, these revenues allow local governments much wider discretion on fiscal policies.

The municipal council is responsible for all local government activities, that is, fiscal policies and service provision. National and local elections are held every fourth year in Norway, but with an interval of two years between them. The local council is elected via a proportional representation system. The council subsequently elects an executive board being responsible for the day-to-day operation of the municipality. All larger political parties are represented within the executive board.

Local government revenues

Local government revenue derives from multiple sources. Taxes on income and assets constitute nearly half of municipal revenues, and the other main source of revenues is the general-purpose grant. In principle, local governments can reduce the income tax-rates below the centrally determined maximum rates, but no municipality exploits this option. Local governments therefore exert little influence on these revenue components, at least in the short run. However, the local authorities enjoy a high level of discretion in terms of how they spend the revenues, subject to meeting the national quality standards on schooling, health care and social services provision.

As mentioned, local governments receive additional revenues from hydropower plants, in some cases very substantial revenues. These revenues derive from multiple sources, the most important being the commercial property taxes. Additional revenues come from licensed electricity production, fees on electricity production, natural resource taxes, and dividend from hydropower plants owned by local government. Importantly, with the exception of the natural resource tax, these revenues are not included in the revenue equalization component of the block grant scheme. Local governments can allocate these revenues anyway they like.

Distinct rules apply for defining the taxable values of hydroelectric power plants. For the larger power plants (>10 MW), the taxable value is calculated as net present value over an infinite time period. Net revenues are defined by average net sales revenues over the last five years. For the smaller power plants (<10MW), taxable values are defined as tax-deducted balance value of investments. This implies that property taxes can be high for new plants.

Local governments can collect additional revenues from user charges (home-care services, nursing homes, day-care centers, infrastructure services, waste collection and treatment, water supply, and sewage). However, these revenues cannot exceed the cost of providing these services. Finally, matching grants and non-matching earmarked grants are relatively small, and are used for child care services and to cover the costs of integration of refugees.

4 Empirical strategy and data

Our estimating equation is given by,

$$y_{it} = \alpha_1 \widehat{R}_{it} + \mathbf{x}_{it}\alpha_2 + \mu_i + \delta_t + e_{it}, \tag{1}$$

where y_{it} is a particular political or economic outcome in local government i in year t, $\widehat{R}_{it}$ is a measure of local government revenue windfalls (per capita), $\mathbf{x}_{it}$ is a vector of time-varying local government characteristics, μ_i is a set of local government (or labor market, or county) fixed effects, δ_t is a set of year fixed effects, and e_{it} is an error term, assumed to be i.i.d..

The fiscal windfall $\widehat{R}_{it}$ cannot be directly observed in the data. We therefore, in a first stage, regress total local government revenues, R_{it}, on measures of hydropower production. Specifically, we estimate the following model,

$$R_{it} = \mathbf{H}_{it}\beta_1 + \mathbf{x}_{it}\beta_2 + \gamma_i + \rho_t + u_{it} \tag{2}$$

where $\mathbf{H}_{it}$ is a vector of excluded (in equation 1) hydropower production instruments (see below for precise definition), and γ_i, ρ_t, and u_{it} are the fixed effects (as in the first-stage) and the error term, respectively. Using the resulting output from estimating Model (2), we obtain a measure of local government revenue windfalls that derives exclusively from hydropower production, $\widehat{R}_{it}$. Plugging $\widehat{R}_{it}$ into equation (1) and estimating the system using 2SLS, we obtain a consistent estimate of our key parameter of interest, α_1.

Clearly, the estimate of α_1 may only be interpreted as the causal effect of local government revenue windfalls on the various outcomes y_{it} to the extent that the first-stage is informative (relevance), and that the excluded vector of instruments, $\mathbf{H}_{it}$, affect y_{it} exclusively via their impact on R_{it} (excludability). The institutional characteristics (as reviewed above) suggest that the timing of hydropower plant openings are as good as random or, at the very least, difficult to predict. The extent to which future hydropower production additions can be predicted using current or historic municipality characteristics may be directly tested, by regressing the accumulated additions of hydropower capacity on a battery for predetermined municipality characteristics.

Below we define the main variables and describe their properties in more detail.[14]

Instruments: Hydropower production variables

Data from the NVE provides us with detailed information on each municipality's individual hydropower stations, their respective opening years, their expected hydropower production (measured in MWh or GWh), and their production capacity (measured in MW). Our baseline instrument, *Hydro: MWh per capita*, is defined as the aggregate (over the plants) expected annual municipality-level production, as defined by NVE. Hence, annual production is not based on registered production at the power plants, but on historical data on the inflow of water during a reference period which usually extends over 30 years (1981-2010), which defines the value of the plant (also used in the tax schemes). Not that, when a new plant comes into operation, our measure of hydropower production in the municipality jumps discretely to a higher level.

We also have information on the maximum capacity of the plants located in the municipality (measured in MW). Since large and small hydropower stations are subject to different tax rules, we split our hydropower instrument in two: *Hydro: MWh per capita, <10MW* and *Hydro: MWh per capita, >10MW*, where the former refers to the small (<10 MW) and the latter to the large (>10 MW) stations. A given municipality may have no,

[14] Summary statistics for the different variables can be found in Online Appendix Table A1.

one, or several small and/or large hydropower stations.[15]

Local government revenues

We define total revenues as the sum of local government revenues coming from the general purpose grant, taxes on income and assets, property taxes, and natural resource taxes on hydropower production for the 1991-2015 period.[16] This is our baseline local government revenue concept.

Local governments levy commercial property taxes on hydropower facilities, and specific data on this revenue component is available for 2007-2015 only. We have supplementary data on other revenue sources which are mostly relevant for the hydropower sector: Data divided on enterprises (owned by local governments) are available from 2001, concession taxes are available from 2003, and data on sales of licensed hydropower production from 2007.

For illustration, in the left panel of Figure 4 we present a cross-sectional snapshot using data from 2015 on the relationship between hydropower production (our instrument) and total local government revenues per capita (in logarithms).[17] In the right panel of Figure 4, we present a similar plot, but focusing on energy revenues in total revenues (in percentages). In both plots, we have highlighted the most hydropower intensive municipalities by blue dots (i.e., those with production $>$ 500 MWh per capita, in total 22 municipalities). There are several striking similarities between the two plots. Both variables (total revenues and energy-to-total revenues) display strong, positive correlations with the level of hydropower production. Moreover, focusing in the identity of the blue dots, there is a strong correspondence across the two graphs – hence, there is a strong tendency that the more hydropower production intensive municipalities (i.e., those to the right in the plots) both have high total government revenues *and* a high share of energy revenues in total revenues.

[15] In Online Appendix Figure B3, we display data on the timing of plant openings in Norway from 1910 onwards. Most of the hydropower system was established in the 1960s and 1970s. In the ensuing analysis, we exploit local government revenue data starting in 1991, which is indicated by the vertical line in the diagram. Note that the hydropower investment wave after 2000 is partly due to the central government's introduction of new subsidies for "green energy". Overall, production capacity has increased from 115 TWh (26859 MW) in 1991 to 121 TWh (28389 MW) a decade later, and up to 133 TWh (31418 MW) in 2015. This implies that we see significant additions to the hydropower system even in this period.

[16] Parts of the data used in this publication are obtained from the Norwegian Center for Research Data - NSD. The NSD is not responsible for the analysis of the data or for the interpretations made here.

[17] Revenues are measured in current prices, as 1000 NOK per capita. Hydropower production is measured in MWh per capita. For comparison with other available sources of resource revenues, the triangles indicate wind-producing municipalities, and the squares show municipalities with natural gas processing facilities.

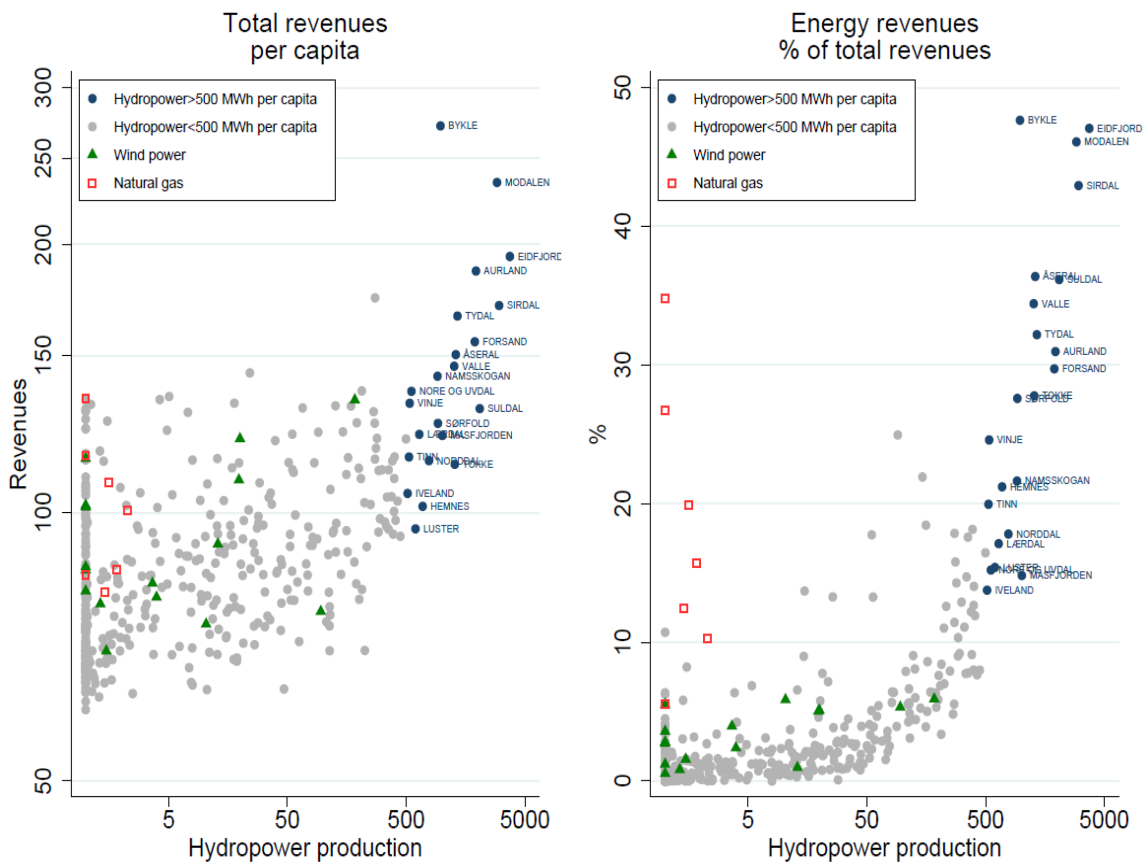

Figure 4: Hydropower production and local government revenues.

Electoral controls: Voter turnout, civic participation and information collection

As in Andersen et al. (2014), we analyze municipality-level register data on voter turnout in the local elections. These data are available for each fourth year starting in the relevant time period (1991-2015) and, importantly, they also include the vote shares of the different parties in both the local and the county council elections. For comparison, we also use data on local level turnout in the national elections (i.e. to the national parliament). In addition, we have access to election surveys with representative samples of eligible voters, conducted every fourth year in the period 1999-2015. Finally, we use information from large population surveys with relevant questions on newspaper consumption, information on contact with local politicians and local government employee, whether citizens actively have gathered information on local political issues, or whether they have tried to influence local decision making (see the notes in the relevant tables for more detailed information of the different surveys).

Constructing our baseline polarization measure, we first aggregate over all municipalities (i.e., the entire country) how eligible voters of different parties place themselves on a left-right "ideology", providing us with a measure ν^P of party P placement (as perceived by the voters). Specifically, the left-right positions derive from a standard survey question included in an extensive survey to representative samples of eligible voters in the period 1999-2015: “Consider a scale where 0 represents those on the political far left, and 10 represents those on the far right politically. Where would you put yourself on this scale?”.[18] The average party positions ν^P of the most common parties are: Socialist Left Party (3.06), Labour Party (4.18), Center Party (4.72), Liberal Party (4.82), Christian Democratic Party (5.56), Conservative Party (6.95), and Progress Party (7.06), where other parties and local lists average at (5.12).[19] Based on this measure, we construct a measure of voter polarization in municipality i in year t, in election $j = M, C$ (to the local and county councils, respectively),

$$Pol_{i,t}^{j} = \sqrt{\sum_P S_{i,t}^{P} \left(\nu^P - 5\right)^2},$$

where “5” is the midpoint of the party placement scale, and $S_{i,t}^{P}$ is the actual vote share of party P in municipality i in election year t. This polarization measure $Pol_{i,t}^{j}$ is akin to those

[18] Survey question in Norwegian: “Tenk deg en skala der 0 representerer de som står helt til venstre politisk, og 10 representerer de som står helt til høyre politisk. Hvordan vil du plassere deg selv på en slik skala?”.

[19] We present descriptive statistics on left-right positions in Online Appendix Table A3.

in, e.g., Dalton (2008: 906) and Curini and Hino (2012). Interpreting this measure, notice that observed polarization will be increasing in the local voters' average deviation from the midpoint of the nationwide left-right party-placement scale. Moreover, the difference $Pol_{i,t}^{M} - Pol_{i,t}^{C}$ measures the extent to which polarization is larger (or smaller) in the local relative to the county council election.

In robustness exercises, but also to ease interpretation, we make use of two alternative polarization measures. First, we calculate a measure of the absolute deviation from the midpoint (rather than $Pol_{i,t}^{j}$, which is comparable to the standard deviation), as $\sum_P S_{i,t}^{P} \left|\nu^P - 5\right|$. Second, and even more directly, we calculate polarization simply as the local vote share for extreme parties, where the extreme left parties are the Red Party (at position 3.04) and the Socialist Left Party, and the extreme right party is the Progress Party.

Political rents: Benefits to the leading politicians and administrators

Our baseline measure of political rents is the wages of the top politicians and bureaucrats in local government, the mayors and the top administrative executive (the chief municipal official, the CMO - "rådmannen"). Importantly, the local council is free to set the top officials' compensation. The data on CMO wage levels include gross regular monthly salary as well as various supplementary compensations from 1991-2015. The 'extras' account for on average only 1% the total wage level. Data on mayors' wage and income levels derive from Statistics Norway, and cover the years 2007-2014.[20] For comparison, we also consider the average wage of local government employees, who are not in a position to influence their own wage compensation. As alternative proxies for political rents, we include measures of the local council size, as well as a measure of internal spending within the local councils (i.e., spending by the council on the council members). The latter measures may be interpreted as proxies for political rents as wasteful spending, although a larger council and a higher level of internal spending indeed may provide utility for the local politicians as well.

[20]Wages are defined as annual gross salary exclusive birth and sickness benefits. Income is defined as annual gross income including wages, pensions and capital income.

5 Results

Table 1 presents our first-stage estimates based on Model (2), regressing total local government revenue (in 1000 NOK per capita) on our hydropower production instruments (in MWh per capita). Notice that, while most of our main (second-stage) regressions allow for municipality fixed effects, some do not (due to limited coverage in the time dimension). Hence, we also estimate the first-stage replacing the municipality fixed effects with either labor market region or county fixed effects, including location (latitude and longitude of the municipality's administrative center) and a dummy variable for the northern zone (which is subject to a special tax and grant treatment by the central government). Additionally, all specifications include a battery of demographic, time-varying covariates (see table notes for details).

Most importantly, Table 1 shows that our excluded hydropower instruments are jointly statistically significant throughout, with F-values ranging from about 33 to about 54 in the less restrictive specifications, replacing the municipality fixed effects with labor market region and county fixed effects.[21] Moreover, all of the instruments are also individually highly statistically significant (at the 0.1 percent level), and the point estimates are relatively stable across all specifications, but slightly larger in the more restrictive specifications.[22]

To get a sense of the economic significance of the hydropower resources for local government revenues, the revenue effect of increasing hydropower production by one standard

[21] In Online Appendix Figure B2, we show how the hydropower revenue components – property taxes, natural resource taxes, concession fee revenues and license revenues - correlate with hydropower production, and in Online Appendix Table A2, we estimate corresponding regressions relating the revenue components to hydropower production.

[22] The standard errors are clustered at the labor market region throughout. This is conservative: standard procedure would suggest clustering on the municipality level to account for positive serial correlation within municipalities (Cameron and Miller, 2015). However, this approach assumes independence across municipalities. A potential concern is that the effects of natural resource abundance affect both the residents of the municipality where the plant (hydropower plant, wind farm, natural gas processing plant) is located as well as the inhabitants of neighboring municipalities. Such spillovers could generate positive within-region correlations in employment rates, wages- and income levels, potentially leading to a downward bias in the estimated standard errors. We therefore cluster standard errors on labor market regions. These 90 regions are defined by Statistics Norway by a center municipality characterized by an independent urban settlement of a minimum population size (depending on the size of settlements in the surrounding area). The labor market regions are delimited by a center municipality and the municipalities in the commuting area. For documentation of the labor marked regions, see Statistics Norway (2001): Classification of economic regions. NOS C 634. Oslo: Statistics Norway: https://www.ssb.no/a/english/publikasjoner/pdf/nos_c634_en/nos_c634_en.pdf.

Table 1. Local government revenues

	(1)	(2)	(3)	(4)
Hydro: MWh per capita	0.0500***			
	(0.00866)			
Hydro: MWh per capita, >10 MW		0.0370***	0.0243***	0.0258***
		(0.00699)	(0.00301)	(0.00330)
Hydro: MWh per capita, <10 MW		0.425***	0.229***	0.205**
		(0.0712)	(0.0565)	(0.0740)
Observations	9,887	9,887	8,975	8,975
R-squared	0.960	0.962	0.857	0.824
Fixed effects	Municipality	Municipality	Region	County
F test	33.37	33.38	54.23	54.34

Notes. The response variable is total current local government revenues, defined as taxes on income and assets, block grants, property taxes and other revenues from hydropower resources. Revenues are measured in 1000 NOK per capita. The first instrument measures overall average annual hydropower production measured in MWh per capita. The estimates in columns (2) – (4) show estimates for hydropower production for plants with capacity above and below 10 MW respectively.

All models use data for the period 1991-2015. Models (1) and (2) are estimated with municipality fixed effects, model (3) with labor market fixed effects (N=90) and model (4) with county fixed effects (N=19). All model specifications include year fixed effects and a set of time-varying covariates: the municipal population size (linear and squared), share of children (ages 0-5 years), share of young (ages 5-15 years), share of elderly (aged 67 years or more), share of women and the employer's national insurance contributions.

The models with labor market region and county fixed effects include controls for the geographic location of the municipalities' administrative center (latitude and longitude) and a dummy-variable for the northern zone having extraordinary benefits (all municipalities in *Finnmark* as seven municipalities in northern *Troms*). The F-test statistic shows a simultaneous test for instruments being equal zero. The standard errors are robust standard errors clustered on labor market regions (in parentheses; N=90).
Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

deviation amounts to about NOK 17,600, or USD 2,000 per capita.[23] This amounts to approximately 70% of the local government total revenue (per capita) standard deviation, and implies a 26% increase in revenues, relative to the average local government total revenue level.

In sum, the results in Table 1 suggest that our hydropower variables are robust and economically significant predictors of local government revenue. The county and municipality fixed effects estimates are very similar, which indicates that time-invariant municipality characteristics do not cause serious bias in those few specifications that rely on county fixed effects. The MWh-estimates are larger when municipalities can levy taxes and collect other revenues from smaller hydroelectric plants (than 10 MW), which is due to the different taxation systems for small and large plants.

In Table 2, we test prediction (*i*) from our theory, that fiscal windfalls are expected to mobilize the electorate so as to increase voter turnout. For transparency, we show both the OLS (upper panel), the reduced form (middle panel), and the IV (lower panel) estimates, throughout. As expected, the results in Column 1 show that the hydropower windfalls indeed increase local council election turnout. All local level coefficients (OLS, reduced form, and IV) are precisely estimated, statistically different from zero at the five percent level throughout, whereas the county council and national election coefficients are consistently small and non-significant, as expected. Comparing the OLS to the IV, the IV estimate is about three times larger than the OLS estimate. Quantitatively, the IV estimate suggests that a windfall amounting to one standard deviation of the local governments' fiscal revenues (about USD 25,640 per capita) increases the local election turnout rate by about 2.8 percentage points, amounting to a 4.4 percent increase relative to the average turnout rate (64 percent). For comparison, the reduced form estimate suggests that a hydropower windfall (expansion) equal to one standard deviation of per capita hydropower production (about 352.1 MWh) boosts local election turnout by about 1.4 percentage points.

In the spirit of Andersen et al. (2014), the regression in Column 3 of Table 2 uses that fact that local and county council elections are simultaneous. This is convenient because using the *difference* in turnout across the two election as our response variable (essentially a triple-difference approach), we implicitly difference out any general trends in voter moods that might affect turnout in both elections. Recall that, while we expect

[23] At the time of writing, the exchange rate is about 8.5 NOK/USD.

Table 2. Voter turnout

	(1)	(2)	(3)	(4)
	Voter turnout in the elections to:			
	Local council	County council	Local council less county council	National parliament
OLS estimates:	0.0332*	-0.000327*	0.0656***	-0.00215
Revenues	(0.0161)	(0.000158)	(0.0167)	(0.00950)
Observations	2,591	2,586	2,586	2,150
R-squared	0.821	0.807	0.720	0.857
Reduced form estimates:	4.079*	-0.0203	6.106**	0.0692
Hydro: GWh per capita	(2.006)	(0.0215)	(1.944)	(1.992)
Observations	3,020	3,015	3,015	2,151
R-squared	0.808	0.801	0.719	0.857
IV estimates:	0.110**	0.000329	0.0766*	0.000636
Revenues	(0.0402)	(0.000485)	(0.0363)	(0.0276)
Observations	2,591	2,586	2,586	2,150
R-squared	0.817	0.804	0.720	0.857

Notes. The upper panel shows OLS estimates indicating the effect of local government revenues on voter turnout. The panel in the mid-section displays reduced-form estimates of hydropower production (GWh per capita), and the lower panel shows IV-estimates of local government revenues (measured per capita, in current prices). The IV-estimates employ hydropower production per capita for plants with capacities smaller and larger than 10MW, see column (2), Table1. The models are estimated with municipality and year fixed effects as well as a set of time-varying covariates: the municipal population size (linear and squared), share of children (ages 0-5 years), share of young (ages 5-15 years), share of elderly (aged 67 years or more), share of women and the employer's national insurance contributions. The response variables are: voter turnout in local council elections (1); voter turnout in the elections to the county councils (2), voter turnout in the local council less county council elections (3), and voter turnout in the elections to the national parliament (*Stortinget*) (4). The estimates rely on data from election years. The standard errors are robust standard errors clustered on labor market regions (in parentheses; N=90).
Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

the fiscal windfalls to affect local council turnout, we expect no (or very minor spillover-) effects in the county council elections or in the elections to the national parliament (held two years after the local elections), as local hydropower windfalls have no direct impact on the county council or national budgets. Hence, comparing the Column 1 and Column 3 estimates is informative about the potential influence of spurious trend effects. Reassuringly, the Column 3 estimates are very similar to the baseline result in Column 1, albeit slightly weaker with the point estimate dropping from 0.110 to 0.077, statistical significance dropping slightly from the one to the five percent level. Interestingly, the difference between the OLS and the IV results almost disappears, suggesting that the triple-difference effectively deals with many of the potential endogeneity issues with the OLS, as argued by Andersen et al. (2014). The triple-difference results in Column 3 suggest that a fiscal windfall of about one standard deviation of local fiscal revenues increases local council election turnout relative to that in the county council election by between 1.5 and 2 percentage points.

In Table 3, we move on to testing prediction (*ii*), that the fiscal windfalls are expected to decrease voter polarization. The regressors are $Pol_{i,t}^{M}$ in Column 1, $Pol_{i,t}^{C}$ in Column 2, and the difference $Pol_{i,t}^{M} - Pol_{i,t}^{C}$ in Column 3. As can be seen, all results are qualitatively consistent across the OLS, the reduced form, and IV-estimates. The results show that fiscal windfalls significantly reduce voter polarization, statistically different from zero at the 5 percent level both in the local council election regressions as well as in the triple difference regression (Column 3). Note that these results do not appear an artefact of our operationalization of polarization – we find very similar effects when considering the absolute deviation and the vote share for extreme parties.[24] While it is difficult to obtain a meaningful economic interpretation of the polarization index effects, interpreting the effects on the vote shares for extreme parties is much more straightforward. Specifically, the IV results for the extreme parties' vote share suggest that a fiscal windfall of one standard deviation of total local government revenues reduces the support for extreme parties (i.e., the Red Party, the Socialist Left Party, and the Progress Party) by 4.7 percentage points, which amounts to as much as 32 percent of the average support for these parties. While the reduced for estimate suggests a similarly sized effect (a 4.7 percentage points reduction in vote share for a one standard deviation increase in hydropower production), the triple difference effects are somewhat weaker (3.4 pp. according to the IV estimate and 1.7 pp.

[24]See Online Appendix tables A4 and A5, respectively.

Table 3. Electoral polarization

	(1)	(2)	(3)
	Voter polarization in:		
	Local council	County council	Local council less county council
OLS estimates	-0.00147	-3.76e-05	-0.00156*
Revenues	(0.000916)	(0.000572)	(0.000770)
Observations	2,592	2,584	2,584
R-squared	0.774	0.866	0.598
Reduced form estimates:	-0.374*	-0.102	-0.270*
Hydro: GWh per capita	(0.152)	(0.0865)	(0.128)
Observations	3,021	3,010	3,010
R-squared	0.756	0.855	0.567
IV estimates:	-0.00570*	-0.000659	-0.00490*
Revenues	(0.00272)	(0.00122)	(0.00248)
Observations	2,592	2,584	2,584
R-squared	0.768	0.865	0.590

Notes. The upper panel shows OLS estimates indicating the effect of local government revenues on electoral polarization. The panel in the mid-section displays reduced-form estimates of hydropower production (GWh per capita), and the lower panel shows IV-estimates of local government revenues (measured per capita, in current prices). The notes to Table 2 yields details on the model specification. Electoral polarization has been measured as in Dalton (2008:906), as the standard deviation of voters' party positions on the 0-10 left-right self-placement scale. Party positions of the left-right axis have been measured on the standard 0-10 self-placement scale, using data from the five Norwegian Local Election studies available from the elections in the period 1999-2015. The positions have been measured by the average score of the left-right position by respondents' party choices in local council and county council elections. The standard errors are robust standard errors clustered on labor market regions (in parentheses; N=90).
Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

according to the OLS).[25] Taken together, our evidence suggests that local government fiscal windfalls considerably reduces the level polarization in local elections.

According to our theoretical discussion, the mechanism behind the decreased polarization result is that voters that care relatively more about economic stakes (relative to party color) participate to a larger extent when politicians have more direct influence over these outcomes. Consistent with this reasoning, we therefore analyze to what extent citizens engage more directly in the political process, via information gathering and interacting directly with politicians and bureaucrats, when the level of local government resource revenues increases. The results in Table 4 (now relying on county rather than municipality fixed effects in some of the regressions, due to short panels) indeed provide indicative support for this interpretation. Higher local government revenues increase: newspaper consumption (Column 1); the rate at which citizens interact with local politicians and bureaucrats regarding "issues of interest" (columns 2 and 3); and the levels of information acquisition and influencing efforts (columns 4 and 5). All estimates are statistically significant at conventional levels and, economically, they suggest that a one standard deviation increase in local government revenue increase: newspaper consumption by about 0.8 standard deviations, amounting to 0.25 more newspaper subscriptions per household (Column 1); the rate of interaction, information acquisition and influencing effort by about 4 percentage points (columns 2-5). That is, an individual becomes about four percentage points more likely to interact with a politician or a bureaucrat, to gather specific information about local government issues, or to try to influence political decision making in specific areas. These results suggest that the fiscal windfalls stimulates political participation more broadly, beyond voting.

In Table 5, we show the results from testing our theory's prediction (*iii*), that the fiscal windfalls limit the extraction of political rents. Our key preferred measure of political rents is direct monetary compensation, in the form of the Mayors' and the CMOs' wages (columns 1 and 3). We also consider the wages of the Mayors and the CMOs relative to the average wage level of local government employees (columns 2 and 4). All of our top officials wage estimates – throughout columns 1 to 4 (both OLS, reduced form, and IV) – are consistently negative, and the IV estimates on the Mayors' relative wage and the CMOs' wage level are statistically significant at the 5 percent level (while the remaining two just fall short of statistical significance at conventional levels).[26] Hence, if anything,

[25] See Online Appendix Table A5 for details.

[26] Note that the Mayor wage regressions rely on county fixed effects due to the short time series for this

Table 4. Citizens' information and influencing effort

	(1) Newspaper consumption	(2) Politicians	(3) Administration	(4) Information	(5) Decision
OLS estimates	0.00219**	0.00192***	0.00147***	0.000888*	0.00179***
Revenues	(0.000736)	(0.000390)	(0.000320)	(0.000372)	(0.000263)
Observations	5,137	32,830	32,797	32,499	32,214
R-squared	0.892	0.064	0.050	0.049	0.035
Fixed effects	Municipality	County	County	County	County
Reduced form estimates:	0.333*	0.0590***	0.0501***	0.0465*	0.0655***
Hydro: GWh per capita	(0.138)	(0.0163)	(0.0126)	(0.0198)	(0.0153)
Observations	5,149	32,831	32,798	32,500	32,215
R-squared	0.892	0.063	0.049	0.049	0.034
Fixed effects	Municipality	County	County	County	County
IV estimates:	0.00691*	0.00180***	0.00153***	0.00140*	0.00199***
Revenues	(0.00300)	(0.000448)	(0.000357)	(0.000572)	(0.000352)
Observations	5,137	32,830	32,797	32,499	32,214
R-squared	0.888	0.064	0.049	0.049	0.035
Fixed effects	Municipality	County	County	County	County

Notes. The upper panel shows OLS estimates indicating the effect of local government revenues on citizens' newspaper consumption, information collection and influencing efforts. The panel in the mid-section displays reduced-form estimates of hydropower production (GWh per capita), and the lower panel shows IV-estimates of local government revenues (measured per capita, in current prices). The notes to Table 2 yields details on the model specification.

Column (1) displays estimates on newspaper consumption, measured as average number of newspapers sold per household in each municipality. The analyses displayed in column (1) exploit annual data for the period 2003-2015.

Columns (2) – (5) exploit individual-level survey data on contacts with politicians, administration; attempts to get information and to influence local government decisions. The survey questions were coded as 0 (no) and 1(yes), and were expressed as follows:

Politicians: *Have you had contact with a politician in local government on issues of interest?* (In Norwegian: Hatt kontakt med en politiker i kommunen om saker som har opptatt deg?) **Administration:** *Have you had contact with a local government employee on issues of interest?* (In Norwegian: Hatt kontakt med en ansatt i kommunen om saker som har opptatt deg?) **Information**: *Have you attempted to get information from local government on issues of interest?* (In Norwegian: Prøvd å få tak i informasjon fra kommunen om saker som har opptatt deg?) **Decision:** *Have you tried to influence a decision in local government bodies?* (In Norwegian: Gjort noe for å påvirke en avgjørelse i kommunens styringsorganer?)

The survey data was collected by the *Agency for Public Management and eGovernment (Difi)*, and derive from four surveys conducted in 2010, 2013, 2015 and 2017. The regression models are linear probability models, and include fixed effects for survey years and counties (N=19). Table 1, column (5), presents additional information on municipality-level control variables. The models include additional individual level controls: education level (4 levels), civil status (4 levels), age (continuous) and gender. (The standard errors are robust standard errors clustered on labor market regions (in parentheses).

Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Table 5. Elite Compensation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Wages						
	Mayor	Mayor – employee ratio	CMO	CMO-employee ratio	Local government employees	Council size	Spending per council member
OLS estimates:	-0.0608*	-0.00212*	-0.138***	-0.00190**	0.00262	0.0410***	0.000665***
Revenues	(0.0280)	(0.000836)	(0.0291)	(0.000714)	(0.00234)	(0.0107)	(0.000159)
Observations	3,380	3,378	9,601	9,593	9,871	9,868	6,608
R-squared	0.372	0.311	0.954	0.793	0.998	0.950	0.906
Fixed effects	County	County	Municipality	Municipality	Municipality	Municipality	Municipality
Reduced form estimates:	-1.474	-0.0607*	-3.415	-0.109	0.791*	0.721	0.0542
Hydro: GWh per capita	(1.048)	(0.0303)	(3.490)	(0.108)	(0.319)	(2.317)	(0.0303)
Observations	3,385	3,383	10,892	10,461	10,760	11,186	6,619
R-squared	0.370	0.309	0.954	0.786	0.998	0.949	0.905
Fixed effects	County	County	Municipality	Municipality	Municipality	Municipality	Municipality
IV estimates:	-0.0500	-0.00199*	-0.153*	-0.00246	0.0163*	0.0182	0.000633
Revenues	(0.0304)	(0.000863)	(0.0631)	(0.00176)	(0.00633)	(0.0365)	(0.000428)
Observations	3,380	3,378	9,601	9,593	9,871	9,868	6,608
R-squared	0.372	0.311	0.954	0.792	0.998	0.950	0.906
Fixed effects	County	County	Municipality	Municipality	Municipality	Municipality	Municipality

Notes. The upper panel displays OLS estimates for local government effects on compensation to the political and administrative elite in local government. The panel in the mid-section shows reduced-form estimates of hydropower production (GWh per capita), and the lower panel shows IV-estimates of local government revenues (measured per capita, in current prices). The notes to Table 2 yields details on the model specification. The table displays estimates on number of seats on the local council and outlays to the operation of the political bodies in the municipality. The CMO (Chief Executive Official), employee (local government employees) and mayor wages are measured in 1000 NOK in current prices. The data on council size and spending on political institutions derive from local government accounts. Data on CMO wage levels derive from the Norwegian Association of Local and Regional Authorities (KS). Both are available for the 1991-2015 periods. Data on wage income for Mayors come from Statistics Norway, and are available for 2007-2013. The standard errors are robust standard errors clustered on labor market regions (N=90).

Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

the fiscal windfalls appear to have a negative effect on elite wages, as suggested by our theory, dispite that the effect on the general wage level of local government employees is positive (Column 5). Interpreting the wage level estimates relative to average elite wage growth, which amounts to about five percent per year during our sample period, our results suggest that the Mayors' and the CMOs' experience a temporary wage stagnation in times of large (one standard deviation) fiscal windfalls. These findings indicate, in line with our key hypotheses, that voters are indeed capable of disciplining politicians' rent extraction. Interestingly, the results are consistent with the findings in Geys et al. (2017) that, while Norwegian CMOs are rewarded for performance, there is no evidence that they are rewarded for luck. In columns 6 and 7, we rely on our two alternative proxies for political rents, capturing government waste via excess spending on politicians. We detect no significant effects on the size of the local council, nor on the councils' internal spending per council member. Although our proxies by no means constitute exhaustive measures of political rents, citizens appear able to hold their political leaders accountable for their spending. If anything, our results indicate that political rents and government waste are reduced when the local government receives a fiscal windfall, which is also supported by survey data on citizens' own perceptions of the political situation.[27]

While analyzing the broader welfare effects of the observed accountability mechanism is beyond the scope of this paper, the data suggests such effects may be relevant. In auxiliary analyses we do indeed find positive windfall effects on both total employment and median income levels in the municipalities.[28] This stands in sharp contrast to the disappointing welfare effects observed elsewhere (e.g. in Brazil, as discussed in the Introduction). However, we may not conclude whether these positive outcomes mainly derive from less government waste and rents due to the accountability mechanism, or if they are the primarily driven by the overall increase in fiscal spending, potentially accompanied by macroeconomic general equilibrium mechanisms of the fiscal windfalls – plausible, they result from a combination of the two.

variable, while the CMO wage regressions employ the full battery of municipality fixed effects.

[27] The evidence in Online Appendix Table A9 suggests that the hydropower windfalls increase citizens' perceptions of the degree to which politicians listen to their demands (Column 1) and their trust that politicians indeed strive to meet these demands (Column 2). There are, however, no significant effects on their perceptions of state (Column 3) or local (Column 4) government corruption.

[28] See Online Appendix Table A7 for details.

6 Robustness

We argue – based on institutional characteristics – that the fiscal windfalls are (or behave as if they are) unexpected. We test this claim more rigorously by, first, estimating a regression that aims at predicting future hydropower additions based on historical and current local characteristics. Specifically, we include in the specification a battery of municipality characteristics (the unemployment rate, demographic variables, and employers' social security contribution) in the starting year of our main sample period, as well as the accumulated hydropower production capacity up to this point in time. The explanatory power of these variables are very low – even together, local characteristics and the municipality's hydropower history cannot explain future hydropower additions (controlling for labor market region fixed effects).[29] Second, we estimate a lead-lag model for the hydropower windfall effects on local government revenues (i.e., lead-lag version of our first stage regressions in Table 1). The main takeaway is that there are no visible pre-windfall effects (that is, up to the time of significant expansions of the hydropower capacity), then a clear contemporaneous jump, and finally some contraction in the period after.[30] In sum, these results strongly support the notion that the fiscal revenue windfalls do not materialize until the moment (year) of plant openings.

The exclusion restriction assumes that hydropower windfalls affect our outcome variables exclusively via the local government revenues. While this assumption cannot be tested directly, we check robustness by restricting the sample to municipalities where alternative channels (e.g., via labor market spillovers) are highly unlikely, defined by direct employment in hydropower production being no larger than 1 percent of total employment in the municipality. This reduces the overall sample size by about 30 percent, across specifications. All results on turnout, polarization, and elite compensation are largely consistent with our main results, the main exception being the lower precision of the polarization results.[31] Overall, the results from this exercise strongly suggest that our main results are not driven by direct labor market spillovers.

Finally, we show that our main results are robust to replacing the hydropower instrument with a different source of exogenous variation in government revenues that has the advantage that it, almost certainly, operates exclusively via the local government bud-

[29] See Online Appendix Table A6.
[30] See Online Appendix Figure B4 for a graphical representation of this analysis.
[31] See Online Appendix Table A8 for details.

gets.[32] In particular, we use a reform in the regional grant system that discontinuously increased the central government's transfers to small municipalities, in steps. Even though the variation in this alternative instrument is more restricted relative to our hydropower production instrument – the number of affected municipalities is only about half of that in the hydropower case, and the changes in transfers are fewer and much more modest in size – we see very similar patterns, albeit not always statistically significant at conventional levels: increased transfers result in increased turnout, decreased polarization, increased newspaper consumption, and decreased elite compensation.

7 Conclusion

Political elites can enrich themselves when the treasury benefits from exogenous revenue windfalls. An extensive literature finds support for this proposition. Fiscal windfalls tend to end up in the pockets of the elite or vanish into thin air, and the economic gains to ordinary citizens are meager or nonexistent.

We argue that this interpretation is overly pessimistic, at least as a general model of electoral capacity to discipline elected politicians. Democratic elections are, arguably, more competitive when a larger share of moderates cast their votes, effectively forcing parties to compete over a larger mass of voters that are willing to switch party. By contrast, citizens with extreme preferences have a strong intrinsic motive to participate at elections independent of the current election stakes, and they are strongly inclined to support their favorite party even if the other party (or other parties) change policy. By implication, the extreme voters are less inclined to oust an incumbent even when (s)he displays blatant corruption or incompetence. According to our argument, the participation of centrists is key to 'throwing out the rascals', independent of their party affiliation. This accountability mechanism forms our key hypothesis.

To test this hypothesis, our empirical analysis exploits revenue shocks to Norwegian local governments generated by the openings of hydropower plants. We argue that the timing of these plant openings are as good as randomly assigned. When hydropower production starts, local governments collect a series of additional revenues. We therefore instrument local government revenues using a measure of local hydropower production capacity. We show that the added revenues cause higher levels of voter turnout, and that voter polar-

[32] The results can be seen in Online Appendix Table A10.

ization declines. Furthermore, the revenue shocks induce citizens to be more active in contacting their local representatives. Higher revenues also prompt citizens to seek information actively, which is clearly visible in survey data as well as newspaper subscriptions. Finally, we show that the additional revenues do not benefit the administrative and political elite, but appear to gain the local government employees as well as the population at large, in terms of higher employment and income levels. A triple-difference approach as well as a set of robustness tests add credibility to our claim that our estimates may be interpreted as causal.

These empirical findings corroborate our proposition: An increase in the economic stakes of elections mobilizes citizens to vote and, at the margin, the turnout effect is stronger among the more centrist citizens. The increased electoral participation by centrists, in turn, reduces voter polarization and increases – via electoral competition – the extent to which political representatives are held accountable for their spending priorities.

Literature

Alcott, H. and D. Keniston. 2017. "Dutch Disease or Agglomeration? The Local Economic Effects of Natural Resource Booms in Modern America." *Review of Economic Studies* 0, 1-37.

Andersen, J. J., J. H. Fiva, and G. J. Natvik. 2014. "Voting When the Stakes Are High." *Journal of Public Economics* 110, 157-166.

Andersen, J. J., N. Johannesen, D. D. Lassen, and E. Paltseva. 2017. "Petro Rents, Political Institutions, and Hidden Wealth: Evidence from Offshore Bank Accounts." *Journal of the European Economic Association* 15(4), 818-860.

Aragón, F. M. and J. P. Rud. 2013. "Natural Resources and Local Communities: Evidence from a Peruvian Gold Mine." *American Economic Journal: Economic Policy* 5(2), 1-25.

Bandiera, O., A. Prat, and T. Valletti. 2009. "Active and Passive Waste in Government Spending: Evidence from a Policy Experiment." *American Economic Review* 99(4), 1278-1308.

Berman, N., M. Couttenier, D. Rohner, and M. Thoenig. 2017. "This Mine is Mine! How Minerals Fuel Conflicts in Africa." *American Economic Review* 107(6), 1564-1610.

Borge, L.-E., P. Parmer, and R. Torvik. 2015. "Local Natural Resource Curse?" *Journal of Public Economics* 131, 101-114.

Brennan, G., and J. M. Buchanan. 1980. *The Power to Tax: Analytical Foundations of a Fiscal Constitution.* Ann Arbor: Texas A & M Press.

Brollo, F., T. Nannicini, R. Perotti, and G. Tabellini. 2013. "The Political Resource Curse." *American Economic Review* 103(5), 1759-1796.

Cameron, A. C. and D. L. Miller. 2015. "A Practitioner's Guide to Cluster-Robust Inference." *Journal of Human Resources* 50, 317-372.

Caselli, F. and G. Michaels. 2013. "Do Oil Windfalls Improve Living Standards? Evidence from Brazil." *American Economic Journal: Applied Economics* 5(1), 208-238.

Corden, W. M. and J. P. Neary. 1982. "Booming Sector and De-Industrialisation in a Small Open Economy." *The Economic Journal* 92, 825-848.

Curini, L. and A. Hino. 2012. "Missing Links in Party-System Polarization: How Institutions and Voters Matter." *Journal of Politics* 74(2), 460-473.

Cust, J. and S. Poelhekke. 2015. "The Local Economic Impacts of Natural Resource Extraction." *Annual Review of Resource Economics* 7, 251-268.

Dalton, R. J. 2008. "The Quantity and the Quality of Party Systems: Party System Polarization, Its Measurement, and Its Consequences." *Comparative Political Studies* 41(7), 899–920.

Degan, A. and A. Merlo. 2011. "A Structural Model of Turnout and Voting in Multiple Elections." *Journal of the European Economic Association* 9, 209-245.

Feddersen, T. J. and A. Sandroni. 2006. "Ethical Voters and Costly Information Acquisition." *Quarterly Journal of Political Science* 1(3), 287-311.

Ferejohn, J.. 1986. "Incumbent Performance and Electoral Control." *Public Choice* 50(1), 5-25.

Finseraas, H.. 2017. "The Effect of a Booming Local Economy in Early Childhood on the Propensity to Vote: Evidence from a Natural Experiment." *British Journal of Political Science* 47, 609-629.

Fiva, J. H., A. Halse, and G. J. Natvik. 2017. "Local Government Dataset." Available online at: http://www.jon.fiva.no/data.htm.

Gadenne, L.. 2017. "Tax Me, but Spend Wisely? Sources of Public Finance and Government Accountability." *American Economic Journal: Applied Economics* 9(1), 274–314.

Gentzkow, M., J. M. Shapiro, and M. Sinkinson. 2011. "The Effect of Newspaper Entry and Exit on Electoral Politics." *American Economic Review* 101, 2980-3018.

Glaeser, E. L. and R. E. Saks. 2006. "Corruption in America." *Journal of Public Economics* 90(6), 1053-1072.

Hodler, R., S. Luechinger, and A. Stutzer. 2015. "The Effects of Voting Costs on the Democratic Process and Public Finances." *American Economic Journal: Economic Policy* 7(1), 141-171.

Komarek, T. M.. 2016. "Labor Market Dynamics and the Unconventional Natural Gas Boom: Evidence from the Marcellus Region." *Resource and Energy Economics* 45, 1-17.

Knutsen, C. H., A. Kotsadam, E. Hammersmark, and T. Wiig. 2017. "Mining and Local Corruption in Africa." *American Journal of Political Science* 61(2), 320-334.

Larcinese, V.. 2007. "The Instrumental Voter Goes to the Newsagent: Demand for Information, Marginality and the Media." *Journal of Theoretical Politics* 19, 249-276.

Levy, G. and R. Razin. 2015. "Correlation Neglect, Voting Behavior, and Information Aggregation." *American Economic Review* 105(4), 1634-1645.

Løken, K. V.. 2010. "Family Income and Children's Education: Using the Norwegian Oil Boom as a Natural Experiment." *Labour Economics* 17(1), 118-129.

Martínez, Luis R.. 2016. "Sources of Revenue and Government Performance: Evidence from Colombia." Working Paper, Downloadable at SSRN: https://ssrn.com/abstract=3273001, or http://dx.doi.org/10.2139/ssrn.3273001.

Mehlum, H., K. Moene, and R. Torvik. 2006. "Institutions and the Resource Curse." *The Economic Journal* 116, 1-20.

Michaels, G.. 2010. "The Long Term Consequences of Resource-Based Specialisation." *The Economic Journal* 121, 31-57.

Monteiro, J. and C. Ferraz. 2014. "Learning to Punish: Resource Windfalls and Political Accountability in Brazil." Working Paper, downloadable at: https://sites.google.com/site/claudferraz/.

Paler, L. 2013. "Keeping the Public Purse: An Experiment in Windfalls, Taxes, and the Incentives to Restrain Government." *The American Political Science Review* 107(4), 706-725.

Palfrey, T. R. and K. Poole. 1987. "The Relationship between Information, Ideology, and Voting Behavior." *American Journal of Political Science* 31(3), 511-530.

Persson, T. and G. Tabellini. 2000. Political Economics: Explaining Economic Policy. Cambridge, MA: MIT Press.

van der Ploeg, F. 2011. "Natural Resources: Curse or Blessing?" *Journal of Economic Literature*, 49(2), 366-420.

Polo, M. 1998. "Voters' Heterogeneity, Electoral Competition and Political Rents." Manuscript. Milan: Innocenzo Gasparini Inst. Econ. Res., Dept. Econ..

Riker, W. H. and P. C. Ordeshook. 1968. "A Theory of the Calculus of Voting." *American Political Science Review* 62(1), 25–42. *Development Economics* 79(2), 447-468.

Rodon, T. 2017. "When the kingmaker stays home: Revisiting the ideological bias on turnout." *Party Politics* 23(2), 148–159.

Snyder Jr. J. M. and D. Strömberg. 2010. "Press Coverage and Political Accountability." *Journal of Political Economy* 118(2), 355-408.

Wittman, D. 1989. "Why Democracies Produce Efficient Results." *Journal of Political Economy* 97(6), 1395–1424.

Theory Appendix

This section illustrates our proposed accountability mechanism in the simplest possible theory setting we can think of, that captures two dimensions of conflicts of interests: across citizens with different ideological (or party) biases, and across citizens and parties that disagree over the level of political rents. In short, we propose a model where each party commits to a level of political rents (or waste), but where Bertrand competition to zero rents may fail due to discontinuities in the distribution of voter preferences.

Key assumptions

Consider an electorate consisting of a continuum of citizens of mass one, and two parties $P = L, R$ that compete in an election race by simultaneously committing to policy platforms that only differ by their respective levels of political rents, ρ_P. Citizens take, sequentially, two independent decisions: first, whether to participate in the elections and, second (conditional on participation) which party to vote for. At the participation stage, citizen i's participation preferences is captured by three variables: first, a measure of how intensely she feels about the parties (or ideology) per se, where σ^i is her bias toward party R (and, hence, $-\sigma^i$ is her bias toward party L); second, how high she perceives the overall stakes of the election to be, S^i; third, her perceived cost of voting, C (for simplicity assumed to be uniform across voters). At the voting stage, when her participation decision is sunk, the citizen only cares about her (relative) party preferences and the parties' respective rent policies. The two parties are identical in all respects except their party tags, and both parties only care about their expected utilities from consuming political rents. The party that wins a majority of the votes wins the election.[33]

More specifically, a citizen's turnout decision is based on a simple calculus of voting á la Riker and Ordeshook (1968) without the instrumental voting term, since no citizen is individually pivotal. Citizen i's net benefit of voting B^i can be expressed as:

$$B^i = \left|\sigma^i\right| + S^i - C, \tag{3}$$

where σ^i is citizen i's preference bias towards party R (which may be negative or positive)

[33] In the case that both parties receive the same number of votes, the vote is split randomly and each party's win probability is equal to 1/2. To simplify the analysis, we assume that parties are risk averse so, when comparing two policy platforms with the same expected utility but different risk profiles, they strictly prefer the less risky to the more risky platform.

and, hence, $\left|\sigma^i\right|$ is the intensity of citizen i's feelings for either L or R (see Figure 2 for an illustration). A citizen participates at the election if $B^i \geq 0$, otherwise she abstains.[34]

To make progress, we assume that σ^i and S^i are orthogonal and characterized by:

$$\sigma^i \sim U\left[-\frac{1}{2\varphi}, \frac{1}{2\varphi}\right], \tag{4}$$

$$S^i \sim U\left[0, S^{hp}\right], \tag{5}$$

where the parameter $\varphi > 0$ and the indicator hp ("hydropower") reflect citizens' general perceptions of the state of the world. In particular, $hp = l, h$, where S^l is the case of low stakes and S^h is the case of high stakes, and we assume a monotone correspondence between the election stakes and hydropower windfalls such that $hp = l$ and $hp = h$ refer to the cases of low and high levels of hydropower windfalls, respectively. Hence, a hydropower windfall flattens out the S^i-distribution, and shifts up its upper bound. Finally, we assume that $C > S^h > S^l > 0$.[35]

At the voting stage – when the turnout decision has been made and the cost of participation C is sunk – a citizen votes for the party that promises the lowest level of rents, corrected for her ideological bias. That is, citizen i will vote for party R if

$$\sigma^i + (\rho_L - \rho_R) > 0, \tag{6}$$

otherwise she votes for L. If Eq. (6) holds with equality, her vote is decided by a coin toss (randomly).

Timing of events

Summing up, we assume the following timing of events:

1. The state of the world, S^{hp}, φ, and C is realized.
2. Citizens decide whether to vote or abstain, according to Eq. (3).
3. Parties simultaneously decide on their respective rent strategies, ρ_P.

[34] This way of modelling voter behavior and turnout is akin to, e.g., Degan (2006). In Degan's model, it is also the "middle-of-the-road" citizens that are most likely to abstain (and to aquire political information). While Degan focuses on endogenous information aquisition, holding this channel fixed and shifting her parameter for the election stakes (d) would have similar effects on the turnout pattern as a shift in S^i in our model.

[35] Figure 2 graphically illustrates the two distributions. Notice that, the critical assumption is that $S^l < C$ which ensures equilibria in which some citizens abstain in the election, while all of our main results go through even if $S^h \geq C$.

4. The election is held, voters cast their votes according to Eq. (6), the winner, L or R, is decided by vote majority, and the winning party consumes its proposed level of rents.

A simple analysis of the political equilibrium

Parties' trade-off: Electoral competition in this setting means that the parties commit to a level of political rents so as to attract votes and win the election. Because the election is deterministic, the parties' trade-off is simple: The party that offers the highest level of utility to more than 50% of the voters wins the election with certainty, so the parties trade off lower rents against the prospect of winning the election, given their anticipation about the other party's rent policy.

Low-stakes equilibrium: Clearly, both parties have the incentive to lower their rent policies to increase their chance of winning the election and consume rents (á la Bertrand competition). However, notice that the equilibrium level of rents will generally not be at zero. The reason is that abstention may generate a gap in the ideology distribution of those citizens that do participate. If so, it is possible for a party to commit to a positive level of rents without losing its marginal voters to the opponent, since the utility cost for these voters to shift over to the opponent (across the ideology gap) is non-zero.

As an illustration of this mechanism, consider the graphical representation in the left panel of Figure 2. Consistent with equations (3) and (4), all voters with $\left|\sigma^i\right| \geq C$ will participate in the election. We refer to this mass as the "core supporters" of either L or R. The mass of these citizens is illustrated by the shaded area in the graph. In addition, some of those citizens with slightly weaker feelings for either of the parties (i.e., with $\left|\sigma^i\right|$ slightly lower than C) will participate, as long as $S^i > 0$. We refer to these as the "self-mobilized voters". Hence, for given parameterizations of the distributions (4) and (5), the total mass of citizens participating in the election can be illustrated by the sum of the shaded area in Figure 2 (left panel) and the area below the (red) dashed line, where the mass of self mobilized voters is a function of S^l. Notice that all citizens with party preference intensity below the threshold $\left|\bar{\sigma}^l\right| = C - S^l$ (found by setting $B^i = 0$ in Eq. (3)) will abstain. We refer to those voters just at $\left|\bar{\sigma}^l\right|$ as the "marginal voters" of the two parties.

High-stakes equilibrium: Assuming that the state of the world switches to $hp = h$, the arguments as in the low-stakes case apply, except that the ideological positions of both marginal L and marginal R voters shift towards the centre of the ideology distribution, as illustrated in Figure 2.

Proposition 1 *Given any parameterization of the ideology and stakes distributions implying a gap in the voter distribution (consistent with Figure 2), in political equilibrium, the upper bound on the level of political rents is given by* $2(C - S^{hp})$*. Hence, citizens will limit the equilibrium level of rents more the higher is the level of hydropower revenue.*

Proof of Proposition 1:

The proof follows by construction and relates to the situation (parameterization) illustrated in Figure 2. Analyzing equilibrium rents when $S^{hp} = S^l$, consider first the situation in which both L and R propose zero rents. Each party expects to receive the vote of their respective core and self-mobilized supporters, the vote is split, and the win-probability of each party is exactly 1/2. However, in this situation, each party has the incentive to deviate and propose positive rents. To see this, consider the case in which R proposes $\rho_R = \varepsilon > 0$ (i.e., marginally positive) while $\rho_L = 0$. Because R's voters are characterized by $\sigma^i \geq C - S^l > \varepsilon$, the inequality in Eq. (6) still strictly holds, and these voters will continue to support R. As the same reasoning holds for party L, this creates an upward pressure on both parties' rent offers.

Now, consider the situation where R proposes $\rho_R = \underline{\rho}^l_P + \varepsilon$, where $\underline{\rho}^l_P \equiv C - S^l$. Then, L may propose $\rho_L = 0$ and win the election with certainty. However, this is clearly not in L's interest, as the latter provides an expected utility for L equal to zero, while matching R by offering $\rho_L = \rho_R$ and splitting the vote provides a strictly positive expected level of rents (equal to $\left(\underline{\rho}^l_P + \varepsilon\right)/2$). This is true for any rent policy in the interval $\left(\underline{\rho}^l_P, \bar{\rho}^l_P\right]$, where $\bar{\rho}^l_P \equiv 2(C - S^l)$. Finally, to understand the upper bound $\bar{\rho}^l_P$, consider a situation where L expects R to propose $\rho_R = \bar{\rho}^l_P + \varepsilon$. If so, L may propose $\rho_L = \underline{\rho}^l_P$ and, by Eq. (6), capture R's marginal voters (i.e., the voters exactly at $\sigma^i = \underline{\rho}^l_P \equiv \bar{\sigma}^l$). Alternatively, she may propose $\rho_L = \bar{\rho}^l_P + \varepsilon = \rho_R$ with expected rents equal to $\left(\bar{\rho}^l_P + \varepsilon\right)/2$ (because the vote is then split randomly). Due to risk aversion, L strictly prefers the certain to the risky outcome (by the standard definition of risk aversion) and proposes $\rho_L = \underline{\rho}^l_P$. Hence, R has the incentive to never increase its rent proposal beyond $\bar{\rho}^l_P$, and the same goes for L.[36]

[36] Notice, however, that both parties offering the upper bound – giving them an expected payoff of $\left(C - S^l\right)/2$ – is not a Nash equilibrium, as either party then has the incentive to offer $\rho_P = C - S^l - \varepsilon$, win the election, and get the expected payoff of $C - S^l - \varepsilon > \left(C - S^l\right)/2$. This suggests a political equilibrium in mixed strategies, where equilibrium rents is constrained to the interval $\left[0, \bar{\rho}^l_P\right)$ (a probability distribution over equilibrium rents). A more detailed characterization of this mixed strategy equilibrium requires additional assumptions and is beyond the scope of the current paper and redundant for the purpose of the simple point we want to make here. For our purpose, it suffices to characterize the upper bound of the equilibrium distribution of rents.

Q.E.D.

Notice that the upper bound on rents has a nice intuition: $2(C - S^{hp})$ is identical to the ideological gap between the marginal voters of the two parties (as illustrated in the left panel of Figure 2). It is this gap that constitutes the foundation for rents and, in political equilibrium, the level of rents is constrained upwards to exactly this level.

Online APPENDIX to

Power to the (Moderate) People!
Fiscal Windfalls and Electoral Accountability

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Table A1. Summary statistics

	N	Mean	Standard deviation	Mini-mum	Maxi-mum
Per capita hydropower production, MWh (1991-2015)	10,793	101.1	352.1	0	3,934
Per capita hydropower production, >10 MW plants (1991-2015)	10,793	96.84	349.1	0	3,920
Per capita hydropower production, <10 MW plants (1991-2015)	10,793	4.283	9.575	0	87.48
Per capita total revenues (1991-2015)	9,914	56.04	25.64	18.01	271.71
Per capita general taxes (1991-2015)	10,777	15.37	6.605	1.598	77.11
Per capita block grants (1991-2015)	10,782	17.22	11.98	0	82.45
Per capita regional grants (1991-2015)	10806	0.792	1.779	0	12.695
Per capita property taxes (1991-2015)	10,791	2.144	5.197	0	59.79
Per capita commercial property taxes (2007-2015)	3,845	2.652	6.561	0	59.79
Per capita, concession fees (2003-2015)	5,578	0.590	2.228	0	36.40
Per capita, licensed power sales (1991-2015)	3,845	0.494	1.606	-5.693	20.24
Per capita, natural resource tax (2001-2015)	6,445	0.786	3.487	0	47.16
Per capita dividend (2001-2015)	6,430	0.804	1.239	-1.712	19.92
The election statistics cover election years in the period 1991-2015:					
Electoral polarization in municipal council elections	3021	1.182	0.269	0.121	1.841
Electoral polarization in county council elections	3010	1.251	0.175	0.745	1.776
Electoral polarization, municipal less council elections	3010	-0.0695	0.181	-1.235	0.803
Voter support for extreme parties in municipal council elections (%)	3021	14.24	10.07	0	57.12
Voter support for extreme parties in county council elections (%)	3010	17.52	7.33	3.19	54.28
Voter support for extreme parties, municipal less council elections (%)	3010	-3.29	6.10	-51.50	22.77
Voter turnout in municipal council elections (%)	3020	64.12	5.99	43.24	86.69
Voter turnout in county council elections (%)	3015	57.77	6.11	31.46	80.54
Voter turnout in parliamentary (national) elections (%)	3015	76.28	3.79	63.53	89.31
Voter turnout, municipal less council elections (%)	2151	6.36	3.55	-11.50	27.25
Number of newspaper subscriptions per household	5149	1.221	0.312	0.389	3.381

Notes. The table displays summary statistics for the data used in the analyses. Hydropower production has been measured separately as annual MWh per capita. We distinguish between production in plants with capacities above and below 10 MW. All revenues are measured relative to the residential municipal population, in 1000 NOK in current prices. Per capita revenues are defined as total gross current revenues, which includes taxes on personal income and assets, block and earmarked grants, property taxes, fees and charges and all types of hydropower revenue (1991-2015). Electoral polarization has been defined as the Dalton (2008; cf. main text and Table 3). Voter turnout (%) is measured at the municipality level, and shows turnout in the municipal, county and parliamentary elections. Voter support for the ‘extreme’ political parties are defined as the sum of support for the Red Party, the Socialist Left Party and the Progress Party.

Table A1. Summary statistics, continued

	N	Mean	Standard deviation	Mini-mum	Maxi-mum
Number of municipal council members (1991-2015)	11,213	27.304	11.345	11	85
Local government spending on council, per member (1991-2015)	6,619	0.132	0.117	0.012	2.878
Wage compensation to chief municipal official (CMO) (1991-2015)	10,919	45.932	19.833	17.607	135.188
Wage compensation to local government employees (1991-2015)	10,787	23.497	7.712	13.092	42.983
Wage compensation to mayor (2007-2013)	3,403	58.002	17.607	0	209.273
Total employment rate (2000-2015)	6,873	49.971	3.395	37.371	99.200
Median income level (1993-2015)	9,909	228.019	75.740	94.100	448.400
Number of newspaper subscriptions per household (2003-2014)	5,149	1.221	0.312	0.389	3.381
Population size (1991-2015)	10,806	10667	31251	328	647676
Share of children (1991-2015)	10,806	0.077	9.915	0.032	0.148
Share of young (1991-2015)	10,806	0.125	0.020	0.058	0.193
Share of elderly (1991-2015)	10,806	0.166	0.037	0.066	0.325
Share of women (1991-2015)	10,806	0.496	0.010	0.431	0.537
Social security tax rate (1991-2015)	10779	10.621	4.403	0	16.7
Survey data (from 2010, 2013, 2015 and 2017):					
Contact with a politician (dummy)	41,354	0.189	0.136	0	1
Contact with a case worker (dummy)	41,322	0.373	0.119	0	1
Sought information on issues of interest (dummy)	40,915	0.376	0.111	0	1
Attempted to influence a decision (dummy)	40,575	0.159	0.110	0	1
Politicians' are listening (index 0-100)	34,420	51.85	8.58	0	100
Trust in local politicians (index 0-100)	38,318	55.12	9.21	0	100
Corruption in central government (index 0-100)	23,819	58.25	8.27	0	100
Corruption in local government (index 0-100)	20,817	59.98	9.07	0	100

Notes to Table A1 continued: Table 5 yields further details on local government spending on council operations, monthly wage compensation to CMOs, local government employees and mayors. Note that the median income level is defined on an annual basis. The total employment rate is defined as number of employees to the working age population (aged 15–64): Employees are defined as persons performing paid work for at least one hour during a reference week. The definition includes people who were temporarily absent from work (illness, holidays, paid leave, or the like), or on compulsory military or civilian service. The statistics cover both wage earners and self-employed. The data include employees in all sectors, including local government and the private sector. Annual data on newspaper subscriptions are available in the period 2003-2015 (Source: Norwegian Media Businesses' Association, downloadable from www.aviskatalogen.no).

Table 4 and Table A8 provide additional information on the survey data, including details on the survey questions. The standard deviations of the survey variables are between-municipality standard deviations, not within-respondent standard deviations.

Children is share of population at pre-school age, i.e., share of population aged 0 to 6 years for the period 1991-1996, and share of population aged 0 to 5 years for the period 1997-2015. Yong is share of population at school age: i.e. share of population aged 7 to 15 years for the period 1991-1996, and share of population aged 6 to 15 years for the subsequent period. Elderly is share of population aged 66 years and higher. Table 4 and Table A8 offer detailed information of survey data, including the survey questions and coding of responses.

Parts of the dataset are due to: Fiva, Jon H., Askill H. Halse and Gisle J. Natvik (2017): Local Government Dataset. Available at www.jon.fiva.no/data.htm.

Table A2. Local government revenue components

	(1) Property taxes	(2) Natural resource taxes	(3) Concession fees	(4) License revenues
Hydro: MWh per capita, >10 MW	0.0125*** (0.0029)	0.0109* (0.0042)	0.0006 (0.0010)	0.0014*** (0.0003)
Hydro: MWh per capita, <10 MW	0.0761*** (0.0164)	0.0353* (0.0165)	0.0138** (0.0044)	0.0074 (0.0065)
Observations	11,144	6,845	5,578	3,834
R-squared	0.8956	0.9357	0.9941	0.2244
Period	1991-2016	2002-2016	2003-2016	2003-2016

Notes. The table displays estimates of hydropower production on local government revenue components (columns 1-4) and total local government spending. The revenue components are measured per capita in columns (1) – (4) are described in the main text. The model specification is similar to Table 1, column (2). The standard errors are robust standard errors clustered on labor market regions (in parentheses; N=90). Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Table A3. Citizens' left-right positions

	Municipal council elections	County council elections
Red Party	3.035 (86)	2.859 (71)
Socialist Left Party	3.055 (485)	3.005 (419)
Labour Party	4.181 (1780)	4.112 (1477)
Centre Party	4.723 (737)	4.728 (692)
Other parties	5.121 (387)	4.954 (304)
Christian Democratic Party	5.562 (432)	5.541 (430)
Liberal Party	4.821 (340)	4.854 (294)
Conservative Party	6.946 (1137)	6.986 (944)
Progress Party	7.058 (585)	7.022 (543)
All	5.146 (5969)	5.128 (5174)

Notes. The table displays the average left-right self-placement of political parties, measured by the assessment of eligible voters. The columns display statistics using five Norwegian Local Elections Surveys related to the elections held in the period 1999-2015. The survey question was: "In politics people sometimes talk of left and right. Using the following scale, where 0 means left and 10 means right, where would you place yourself?" (In Norwegian: "Det snakkes ofte om høyresiden og venstresiden i politikken. Tenk deg en skala som går fra 1 på venstre side - dvs. de som står helt til venstre politisk - og til 10 på høyre side, dvs. de som står helt til høyre politisk. Hvor ville du plassere deg selv på en slik skala?") The responses have been classified by citizens' party preferences in the local council and county council elections. The table displays average values of the left-right scale by party, and number of responses in parentheses.

Table A4. Alternative polarization variable I: Polarization measured by absolute deviations

	(1)	(2)	(3)
		Voter polarization in:	
	Local council	County council	Local council less county council
OLS estimates	-0.00326*	-0.00128	-0.00236
Revenues per capita	(0.00162)	(0.00124)	(0.00167)
Observations	2,592	2,584	2,584
R-squared	0.753	0.858	0.555
Reduced form estimates:	-0.348*	-0.115	-0.233+
Hydro: GWh per capita	(0.151)	(0.0811)	(0.121)
Observations	3,021	3,010	3,010
R-squared	0.731	0.847	0.521
IV estimates:	-0.0132*	-0.00225	-0.0107+
Revenues per capita	(0.00667)	(0.00304)	(0.00593)
Observations	2,592	2,584	2,584
R-squared	0.743	0.857	0.540

Notes. The upper panel shows OLS estimates indicating the effect of local government revenues on electoral polarization; the panel in the mid-section displays reduced-form estimates of hydropower production (GWh per capita), and the lower panel shows IV-estimates of local government revenues (measured per capita, in current prices). The notes to Table 2 yields details on the model specification. Electoral polarization has been measured as the weighted average of *party positions absolute deviation* from the center of the left-right axis, using voter support for the political parties as weights. Party positions of the left-right axis have been measured on the standard 0-10 self-placement scale, using data from the five Norwegian Local Election studies available from the elections in the period 1999-2015. The positions have been measured by the average score of the left-right position by respondents' party choices in local council and county council elections. The standard errors are robust standard errors clustered on labor market regions (in parentheses; N=90).
Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Table A5. Alternative polarization variable II:
Support for the extreme right and left political parties

	(1)	(2)	(3)
	Voter support for extreme right-wing and left-wing political parties in:		
	Local council	County council	Local council less county council
OLS estimates:	-0.0543+	0.00974	-0.0649**
Revenues per capita	(0.0300)	(0.0207)	(0.0214)
Observations	2,592	2,584	2,584
R-squared	0.765	0.801	0.613
Reduced form estimates:	-13.80***	-7.738	-6.082
Hydro: GWh per capita	(3.490)	(5.519)	(4.229)
Observations	3,021	3,010	3,010
R-squared	0.756	0.789	0.596
IV estimates:	-0.182*	-0.0460	-0.134*
Revenues per capita	(0.0849)	(0.0785)	(0.0568)
Observations	2,592	2,584	2,584
R-squared	0.761	0.800	0.610

Notes. The table displays estimates of local government revenues on electoral polarization. The upper panel displays OLS estimates, the panel in the mid-section shows reduced-form estimates of hydropower production (measured in GWh per capita), and the lower panel shows IV-estimates of local government revenues (measured per capita, in current prices). The response variable is the support for the left-wing parties (the Red Party, the Socialist Left Party) and the right-wing party (the Progress Party) in the elections to the local councils and the county councils, both being measured at the municipality level. The notes to Tables 1 and 2 yield details on the model specification. The standard errors are robust standard errors clustered on labor market regions (in parentheses; N=90).
Significance levels: *** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Table A6. Predicting hydropower development

		Production increase in GWh, 1991-2015
Regression	R-squared	0.167
Estimates:	F-test statistic	1.127
	Prob > F	0.353
Descriptive	Means	40.368
Statistics:	Standard deviation	179.961
	Observations	420

Notes. The table shows results from a cross-sectional regression using the increase in total hydropower production (in GWh; see column 2) over the period 1991-2015 as response variable. Explanatory variables in 1991 include: the unemployment rate, share of children (0- 5 years of age), share of young (6-15 years of age), share of elderly (aged 67 years or more), population size, employers' tax contribution rate to social security and total hydropower production at the start of the period in 1991. In addition, we include labor market fixed effects. The F-test statistic and corresponding significance probability is based on simultaneous tests where all covariate estimates are set to zero.

Table A7. Employment rates and income levels

	(1)	(2)	(3)	(4)
	Total employment rates		Median income levels	
OLS estimates:	0.0372***	0.0408***	0.110**	0.0220
Revenues per capita	(0.00838)	(0.00922)	(0.0403)	(0.0483)
Observations	6,813	6,848	8,974	9,010
R-squared	0.599	0.849	0.973	0.992
Reduced form estimates:	1.133***	3.682	6.368***	3.286
Hydro: GWh per capita	(0.272)	(2.136)	(1.620)	(10.70)
Observations	6,838	6,873	9,862	9,902
R-squared	0.587	0.846	0.976	0.993
IV estimates:	0.0405***	0.0906***	0.226***	0.331*
Revenues per capita	(0.0110)	(0.0233)	(0.0663)	(0.142)
Observations	6,813	6,848	8,974	9,010
R-squared	0.599	0.844	0.973	0.992
Fixed effects	County	Municipality	County	Municipality
Period	2000-2015	2000-2015	1993-2015	1993-2015

Notes. The table displays regression estimates of local government revenues on employment rates and income levels. Total employment rates (columns 1 and 2) are measured as total number of employees (aged 16-74) relative to the municipal population (%). Employees are defined as municipal residents working at least one hour per week in a reference week. Median income levels (columns 3 and 4) are defined as gross median income for municipal residents aged 17 or more, measured in 1000 NOK (current prices). The upper panel displays OLS-estimates, the panel in the mid-section shows reduced-form estimates of hydropower production (measured in GWh per capita), and the lower panel shows IV-estimates of local government revenues (measured per capita, in current prices). The notes to Tables 1 and 2 yield details on the regression specification.

Table A8. Robustness to direct employment effects: Municipalities with less than 1% employed in electricity production

	(1)	(2)	(3)	(4)
	Voter turnout in local elections	Ideological polarization	Mayor Wage level	CMO Wage level
OLS estimates:	0.0372*	-0.000848	-0.177***	-0.141***
Revenues per capita	(0.0176)	(0.000895)	(0.0341)	(0.0396)
Observations	2,279	2,280	8,461	3,013
R-squared	0.818	0.773	0.953	0.379
Reduced form estimates:	9.756**	-0.303	-5.098	-3.004
Hydro: GWh per capita	(3.516)	(0.178)	(4.519)	(2.671)
Observations	2,662	2,663	3,018	9,600
R-squared	0.806	0.743	0.374	0.953
IV estimates:	0.236**	-0.00378	-0.252*	-0.121
Revenues per capita	(0.0880)	(0.00406)	(0.120)	(0.0787)
Observations	2,279	2,280	8,461	3,013
R-squared	0.798	0.771	0.953	0.379
Fixed effects	Municipality	Municipality	County	Municipality
Period	1991-2015	1991-2015	2007-2014	1991-2015

Notes. The response variables are defined in Table 2-5. The analyses include observations where number of residential employees working in electricity production and distribution (relative to municipal population, %) is less than 1%. The upper panel displays OLS-estimates, the panel in the mid-section shows reduced-form estimates of hydropower production (measured in GWh per capita), and the lower panel shows IV-estimates. The notes to Tables 1 and 2 yield details on the model specification. The standard errors are robust standard errors clustered on labor market regions (in parentheses; N=90).

Table A9. Trust, responsiveness, and corruption

	(1) Listening	(2) Trust	(3) State corruption	(4) Local gov. corruption
OLS estimates:	0.137***	0.164***	-0.0109	0.00163
Revenues per capita	(0.0269)	(0.0281)	(0.0262)	(0.0255)
Observations	27,200	30,289	16,812	17,013
R-squared	0.029	0.033	0.028	0.015
Reduced form estimates:	2.527	2.913*	0.126	-0.101
Hydro: GWh per capita	(1.414)	(1.261)	(1.491)	(1.901)
Observations	27,201	30,290	16,812	17,013
R-squared	0.028	0.031	0.028	0.015
IV estimates:	0.0807*	0.0912*	0.00602	-0.00386
Revenues per capita	(0.0391)	(0.0359)	(0.0414)	(0.0521)
Observations	27,200	30,289	16,812	17,013
R-squared	0.029	0.032	0.028	0.015

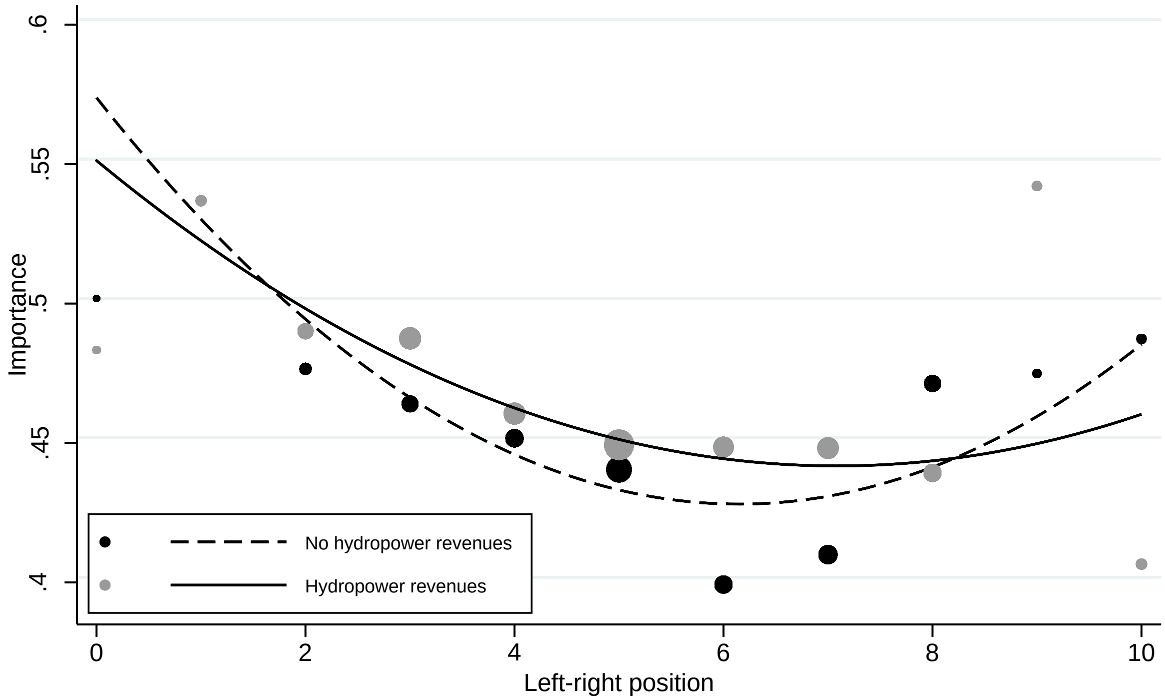
Notes. The survey items were: Listening: *Are you satisfied or dissatisfied with they why local politicians listen to the citizens' viewpoints in your municipality?* Trust: *To what extent do you trust that local politicians work for the benefit of the local population?* State corruption: *Do you think that different kinds of bribing or favoritism occur in in the public sector in Norway (in central government)?* Local government corruption: *Do you think that different kinds of bribing or favoritism occur in in the public sector in Norway (in local government)?* The responses were measured on a 7-point scale coded as follows: 0 (very dissatisfied); 16.7; 33.3; 50; 66.7; 83.3; 100 (very satisfied). The upper panel displays OLS-estimates, the panel in the mid-section shows reduced-form estimates of hydropower production (measured in GWh per capita), and the lower panel shows IV-estimates. For further information on the regression model specification, see notes to Table 4. The standard errors are robust standard errors clustered on labor market regions (in parentheses).

Table A10. Robustness: Regional grants as alternative instrument variable

	(1) First stage	(2) Voter turnout in the elections to: Local council elections	(3) Voter turnout in the elections to: Local council less county council	(4) Voter polarization in: Local Council elections	(5) Voter polarization in: Local council less county council	(6) Newspaper consumption	(7) CMO wage level
Regional Grants per capita	1.471***						
	(0.201)						
Revenues per capita		0.0708	0.102**	-0.0097*	-0.0072	0.0128***	-0.539***
		(0.0759)	(0.0391)	(0.0043)	(0.0043)	(0.0030)	(0.0658)
Observations	2,592	2,591	2,586	2,592	2,584	5,137	9,601
R-squared	0.968	0.820	0.719	0.758	0.564	0.872	0.942

Notes. The tables display IV-estimates using the regional grants per capita as instrument on local government revenues. The regional grants program was established in 1997. It is a lump-sum provision distributed to municipalities with fewer than 3,000 inhabitants and tax revenues below 110 percent of the national average. All qualifying municipalities receive the same amount irrespective of population size. Only municipalities located in designated areas were initially qualified for the regional grants. Starting in 2002, *all* municipalities with populations below 3,000 and lower tax revenues than 110 percent of the national average received the regional grant. From 2004, the population criterion was extended to municipalities with populations between 3,000 and 3,200 residents. Municipalities with 3,000 or fewer inhabitants received the full subsidy, while those with populations between 3,000 and 3,200 became eligible to a reduced proportion of the full rate. Those with populations between 3,000 and 3,049 received 80 percent; those with populations between 3,050 and 3,099 received 60 percent, and so on. From 2009, all municipalities with 3,200 inhabitants or less received the full subsidy, and the threshold for receiving the grant was lifted from 110 percent to 120 percent, relative to the national level of tax revenues.

Column (1) shows the first-stage estimate, using the same controls as in Table 1 (including municipality and year fixed effects). The models also include hydropower production and block grants (exclusive regional grants) as control variables. Columns (2) - (7) display the IV-estimates for key response variables, cf. tables 2,3 and 5. The standard errors are robust standard errors clustered on labor market regions (in parentheses).



Notes. The diagram uses individual-level data from five waves for the Local Election Studies covering the 1999, 2003, 2007, 2011 and 2015 local elections (N=11.683). The datasets include information of citizens left-right self-placement where 0 indicates the extreme left and 10 the extreme right, as well as data on participation in the local elections. We merge these data with municipality-level information on hydropower production. Residents were asked whether the elections to the municipal councils have a major impact (=1), a certain impact (=0.5), or no or little impact (=0) on developments in the municipality in the coming four years. (The coding of responses are indicated in parentheses.) The bubblesizes in the plot are proportional to number of respondents located on each of the left-right positions. The regression lines indicate a quadratic fit to data.

Figure B1. The importance of local elections

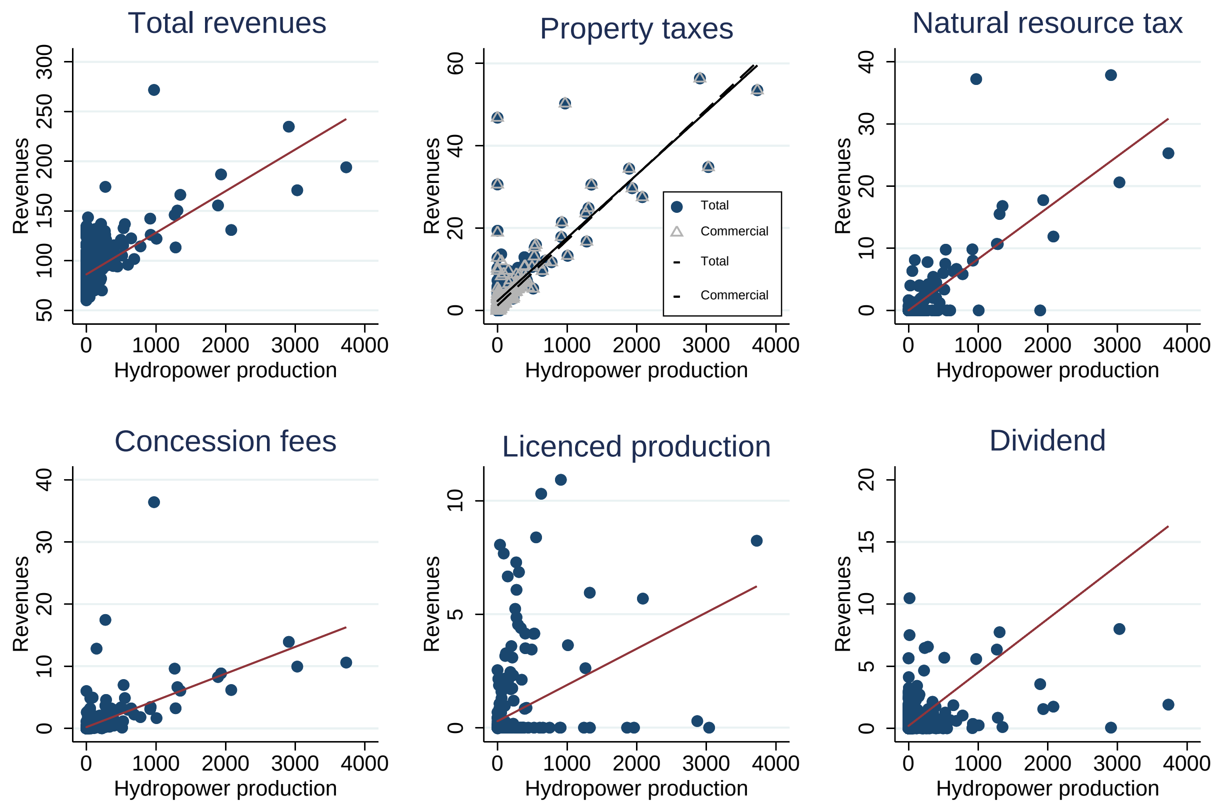
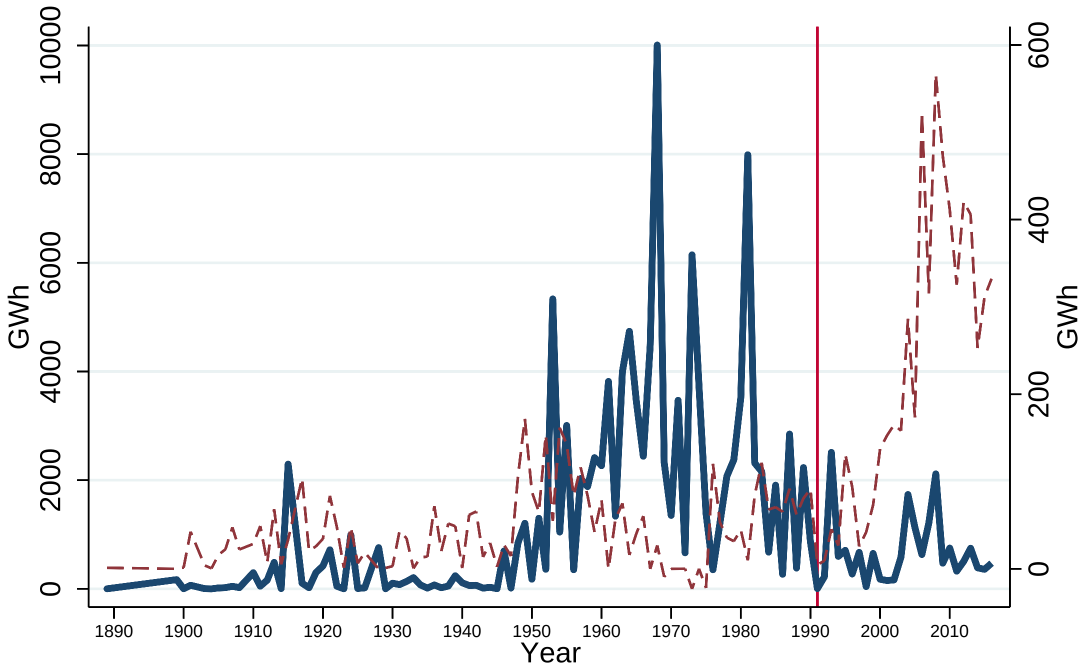
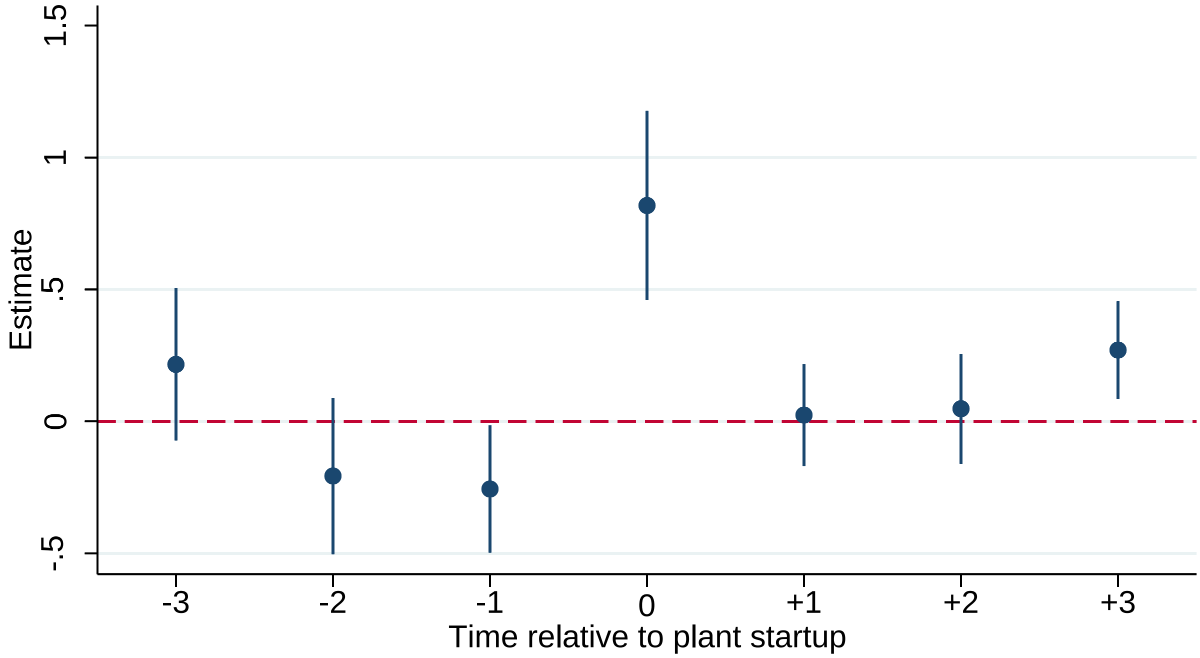


Figure B2. Local government revenues



Notes. The figure shows the annual openings of hydropower production measured in GWh. The dashed line indicates production in plants with a maximum capacity of 10 MW (measured on the right axis).

Figure B3. The opening of hydropower production in Norway



Notes. The dependent variable is yearly increases in total current local government revenues per capita. The estimates display effects of increasing per capita hydropower production in the municipality, coded 1 in years when hydropower production has increased and 0 otherwise. The dummy variable is included with values 3 years before plant openings, when the plant was opened and three years after plant openings. The model includes control for years only. The vertical lines indicate 95% confidence intervals, clustered on economic regions.

Figure B4. Effects of hydropower on local government revenues
Lead- and lag-effects of hydropower production

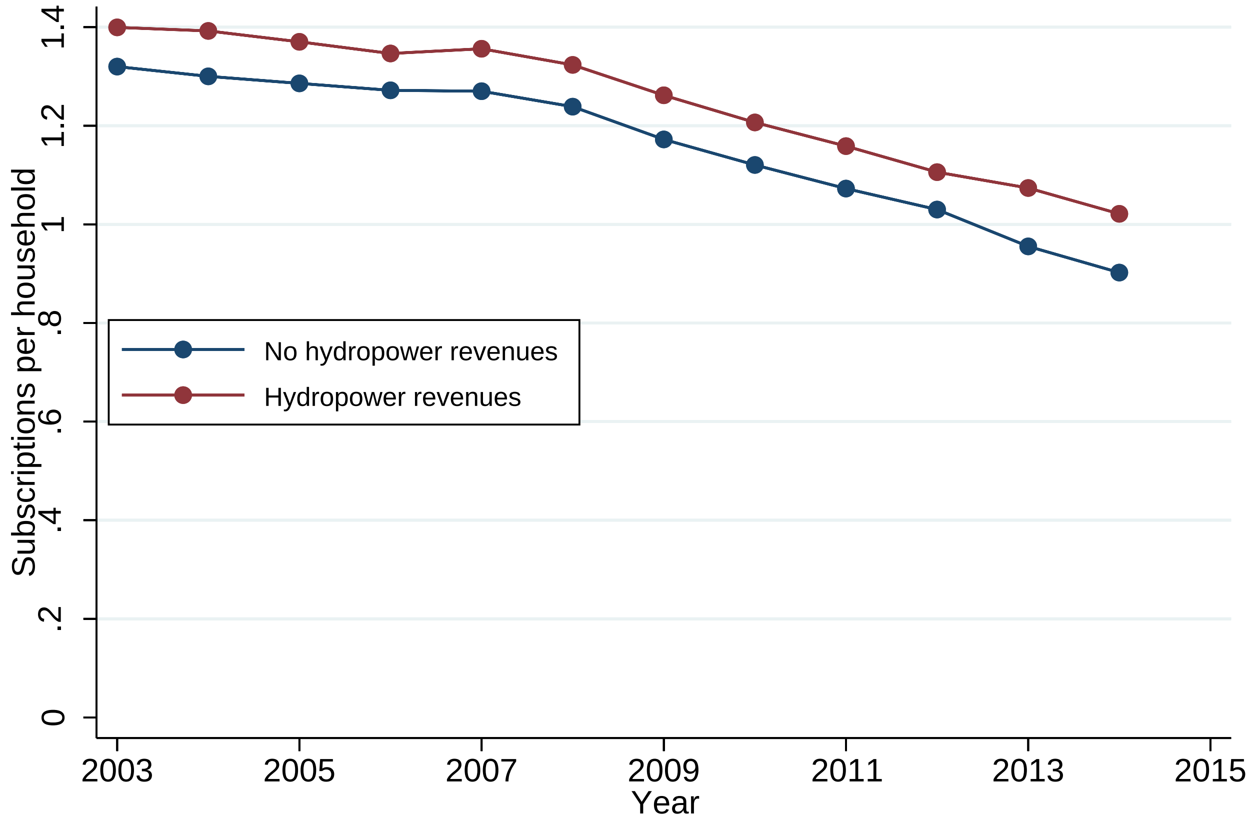


Figure B5. Newspaper coverage